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The contract for the superstructure of the bridge to be built across the East River, between New York and Brooklyn, by the New York & Long Island Bridge Co., has been awarded to the Pencoyd Iron Works, of Philadelphia. The bridge will be a cantilever structure with three spans, two of 846 ft. each, over the east and west channels, respectively, and one over Blackwell's Island, 613 ft. long. (Eng. News, Nov. 29, 1894). The contract calls for about 35,000 tons of metal. Mr. Charles M. Jacobs, C. E., 192 Broadway, New York, is the Chief Engineer of the work.

The proposed plans for a subway to carry University Ave., Rochester, N. Y., under the tracks of the New York Central R. R., are not approved of by Mr. J. Y. McClintock, City Engineer. In a letter to the special committee of the Common Council he points out the importance of the street, and states that the plan proposes to narrow the street from 66 ft. to 50 ft., with a 36-ft. roadway and sidewalks less than 6 ft. wide, while the headway is only 9 ft. for these walks. No provisions are made for making the roof watertight, or for lighting, although the sidewalks will be 400 ft. long, crossing under 20 tracks. The alinement and grades are also bad, and there is no provision for paving the roadway or sidewalks. He considers that the only interest served by the carrying out of the proposed plan would be that of the railway company.

A tunnel four miles long is to be driven by the Delta County Water Co., of Delta, Colo., to bring water from the Gunnison River into the Uncompahgre valley for irrigation purposes. The work will cost about $300,000, but no contracts have been placed yet, and construction will not be commenced before spring. The President of the company is Mr. F. C. Lanzon, and the designing engineer is Mr. Richard Whinnerah, of Ouray, Colo.

Anchor ice has been giving trouble at the intake of the water-works of Evanston, Ill. A request for the facts in the case, sent by this journal to Mr. Henry S. Maddock, Commissioner of Public Works, of Evanston, has brought the following reply, dated Jan. 7, 1895:

The city placed one of Falcon's rotary strainers (see Eng. News, March 30, 1893), at the lake end of our intake pipe in 23 ft. of water; the strainer was located in Lake Michigan, 2,800 ft. off the Gross Point lighthouse, in 1890. The severe northeast storm of last spring shifted it and it was again placed in position late in the fall, but not as strongly secured as it should have been and a severe northeast storm on Dec. 27, 1894, again shifted it, so that anchor ice entered the intake pipe, and choked off the water supply. I consider this strainer the best device invented to secure protection from anchor ice, and our experience shows that the line to follow up is to secure a better protection when located on an exposed point. We are now taking water through a submerged crib, similar to that used by the city of Milwaukee.

An important patent on automatic regulators for dynamos held by the General Electric Co. was declared invalid by Judge Grosscup at Chicago, Jan. 14, in a suit brought by the General Electric Co. against the Western Electric Co.

The most serious railway accident of the week was a head collision of freight trains Jan. 7 near Smithville, O., on the Wheeling & Lake Erie R. R., in which one man was killed and four injured, two of them fatally. Both engines and several cars were wrecked.—A crossing accident occurred Jan. 9 at Lodi, O., in which a Baltimore & Ohio R. R. express train cut in two a coal train on the Wheeling & Lake Erie R. R., which latter train had the right of way. The usual claim of failuure of air-brakes is made.

A serious accident occurred on the Kings County Elevated Ry., Brooklyn, N. Y., on Jan. 10, in which the fireman was fatally injured and the engineer seriously injured. An uptown train was switched into a piece of middle track at Liberty and Snedeker Aves., in order to switch back onto the downtown track for its return trip. Either the track was slippery, or, as the manager believes, the engineer neglected to apply his brakes in time, and the engine struck the bumper at the end of the track with such force as to carry it away, the engine and one car falling into the street and the next car hanging over the edge. Fortunately the train was empty and the brakemen jumped in time. The need for better protection of said places is discussed in our editorial columns.

An electric car on the Park Ave. line at Paterson, N. J., ran away Jan. 10 on the grade leading to the crossing of the New York, Lake Erie & Western R. R. at Market St. The gates were down as a westbound train was just pulling into the station near by. The motorman was unable to stop the car, which broke through the frail gates and struck the rear car of the train about 10 ft. from the back platform, carrying away some of the steam-heating pipes and smashing a window. The electric car had its hood smashed and an axle broken, but nobody was hurt.

A mail car standing in the yards of the Long Island R. R. at Long Island City, N. Y., on Jan. 11, caught fire from an oil lamp and set fire to the sheds. The express sheds, railway pier, eight cars and a row of frame buildings occupied as offices, etc., by the company, were destroyed, involving a loss of $50,000. The mail was saved.

A nitro-glycerine magazine at Fremont, O., belonging to the Ohio & Indiana Torpedo Co., blew up on Jan. 12, the shock of the explosion being felt for miles around, but nobody was hurt. The accident is said to have resulted from the use of an oil stove kept burning to thaw the explosive.

A new trestle near Dundas, Ont., on the Grand Trunk Ry., fell down Jan. 9 while in course of erection. The bents, some of which were very high, were raised by derricks, and fastened by planks spiked to them. When 24 bents had been erected (the last one said to have been 50 ft. high) 16 of them fell and three men were seriously injured.

An explosion of oil tanks occurred at the Standard Oil Co.'s works at Canton, Ind., Jan. 6 and the buildings caught fire. A quantity of oil was destroyed.

The wall of a new house at Frankford Ave., Philadelphia, Pa., gave way Jan. 14, and one man was killed and eight injured. The building inspector said that the face-work was all right, but that the back part, which carried the weight, was very poor. The jury censured the sub-contractor.

An iron bridge five miles north of Carbondale, Pa., fell on Jan. 10 on account of a collision of two trains of coal cars on the structure. The bridge was a single-track structure, carrying a branch of the New York, Ontario & Western R. R. over the New York, Lake Erie & Western tracks.

The floor of a building at 118 W. 28th St., New York city, which was being remodeled as an apartment house, gave way Jan. 11, the old floor beams having broken or slipped from their hold in the walls. Several workmen were in the building at the time, but none were seriously hurt.

A strike of motormen and conductors on nearly all the Brooklyn electric railways went into force on Monday morning. The men ask for 25 cts. per day extra pay and a reduction in the number of trips, so as to keep within the legal ten-hours' working day.

Two great fires have recently destroyed a considerable part of the business district of Toronto, Ont. The first was on Jan. 6, in which the Globe Building and several commercial establishments on Yonge and Melinda Sts. were burned. The second, which was even more serious, occurred Jan. 10, commencing in Melinda St. and burning over nearly two blocks, involving a loss of nearly a million dollars.

A terrible disaster, which resulted in the loss of probably between 50 and 100 lives, occurred at Butte, Mont., Jan. 15. During a fire in the Montana Central Ry. yards several cars of powder caught fire, and exploded with tremendous force, killing a number of firemen and spectators, and maiming many others. There were three separate explosions, the first two breaking nearly every window within a radius of two miles. The fire attracted a large crowd, and hundreds were standing near when the first explosion occurred. Owing to the fact that there were still several cars of powder on the track, and the report that one of the burning warehouses also contained a quantity of powder, few dared after the first explosion to venture to the assistance of the injured. When they did, they were met by the second explosion, and this was soon followed by the third. The reports were heard and the shock felt many miles away.

In the vicinity of Chicago the electric lines are said to be seriously cutting into the suburban business of the steam railways. This is especially the case with the Evanston business of the St. Louis road, and the Illinois Central is struggling with the electric railways running to South Chicago, Grand Crossing, Pullman and other South Side suburbs. The suburban business of the Burlington route is also threatened by a proposed electric system, for which the franchise is obtained, that will connect all the suburban towns as far as Berwyn with the heart of Chicago. The advantages that seem to tell with the electric lines are 10 ct. fares, few transfers, frequent and quick service, and a more pleasant means of travel in good weather. It is said that the officers of the St. Paul system are seriously considering the change of their Evanston branch to an electric line.

The Hudson County Boulevard is now being built under an act of the New Jersey Legislature, of 1891, providing for the issue of $1,000,000 in bonds for this purpose; an extension of the route since then will double this cost. The boulevard will begin at the shore of the Kill von Kull, pass through Bergen Point, Bayonne, Greenville, Jersey City, West Hoboken, Union Hill and Guttenburg, and will end at Weehawken. It will be a little over 18 miles long and 80 ft. wide, with two 10-ft. sidewalks. The center of the road is to be gravel for a width of 20 ft., and the rest will be macadamized. Four bridges will be necessary. About two miles of this boulevard, between the Pennsylvania and the Newark & New York railways, is completed. The route was located by Mr. Eulon W. Harrison, C. E.

The Vienna police, according to a correspondent of the New York "Tribune" who there relates his experience, arrested a man and fined him $4 for throwing paper from his cab into the street, even though his driver stopped and picked up every fragment. The police justice, in imposing the fine, said that Vienna spent so many hundred thousand florins annually for keeping its streets clean, and asked the American: "What kind of a country have you where the citizens have no pride in their city and don't care how they disfigure it?" A little of this same spirit in American cities would largely decrease the expenses of the Street Cleaning Department.

The topographic survey of Baltimore, Md., is well under way, according to the late report of Chief Engineer H. J. Douglas, to the commission in charge. The primary work of triangulation is completed, and this covers 54.7 sq. miles. Topographical field-maps are being made on a scale of 200 ft. to 1 in. for the "annex" and undeveloped parts of the city, field-sheets on a scale of 100 ft. to the inch are being made for the city, and the property maps are made on a scale of 40 ft. to one inch. The final sheets will be in square mile sections, showing 5 ft. contours and all physical objects and the names of owners of property as far as practicable. Fifteen of these latter maps are finished, and twelve are yet to be made. A general reference map of the whole city, on a scale of 500 ft., is being made, with 5 ft. contours. Precise levels have been taken over 29.54 sq. miles, with 281.94 miles traversed, and a total of 2,570 bench-marks established. In the property maps the lots are numbered, and the names of owners are indicated on an attached list, so that in case of change of ownership, the list can be corrected, and the map itself need not be defaced. The total area of the city is 20.54 sq. miles, or 32.21 sq. miles including water areas. The sum of $125,000 was appropriated for this survey; of this $101,540 had been expended on Dec. 1, 1894, and a further appropriation of $61,995 is asked for to complete the work. According to Mr. Douglas' estimate, 75% of the additional sum is needed for the property surveys.

## STONE ARCH UNDER THE N. Y., N. H. & H. R. R., AT PELHAMVILLE, N. Y.

Among the numerous works necessitated by the general improvement of the New York Division of the New York, New Haven & Hartford R. R., which consists in general of widening for four tracks and eliminating grade crossings, was the masonry arch shown in the accompanying cut. This structure carries the railway over a highway at Pelhamville, N. Y., and has only recently been completed. A crossing being required at that point, it was decided to construct an archway through the

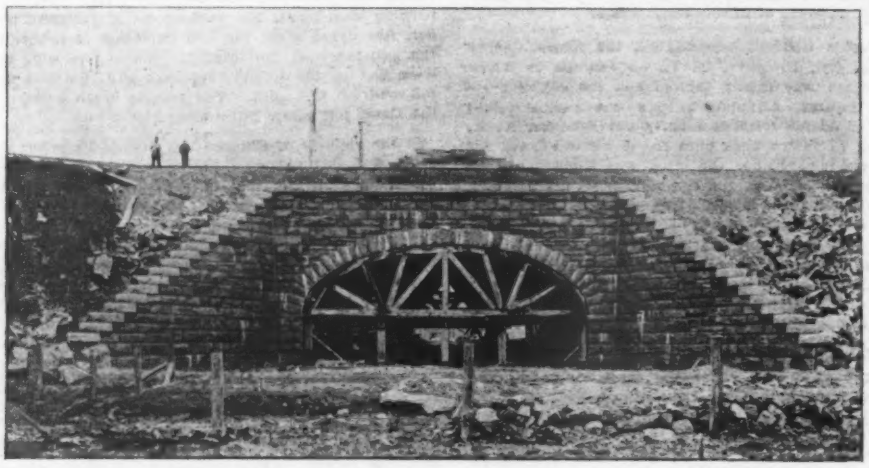


FIG. 1. VIEW OF MASONRY ARCH UNDER NEW YORK, NEW HAVEN & HARTFORD R. R. AT PELHAMVILLE, N. Y.

old embankment, making it low enough to permit the foundations to go down below the original surface, where the embankment was to be widened for two additional tracks. For this reason the roadway was made at practically the level of the original surface. The structure is of very pleasing appearance and is a good example of masonry arch work.

It is a five-center arch of 40 ft. span, with a rise of 10 ft., the springing line being 7 ft. above the roadway. It is square to the line of the embankment, 76 ft. long in the barrel, with wing walls extending at an angle of 45° to the face of the arch. The outline of the intrados corresponds closely to an ellipse of the same span and rise, the greatest variation from the true ellipse line being about 1 in. The theoretical line of pressure under dead load and partial live load lies within the inner third of the arch sheeting, until the short radius is reached, where it passes to the outer edge of the ring stones and thence down through the abutments, remaining within the inner third of the masonry until the foundation is reached. In designing the arch, a joint was placed at each change of curvature, to simplify construction and erection and the use of extra templates was thus avoided. It will also be noticed that the top joints of the three ring stones on either side of the keystone are brought to a level bed, as are also those of the next two adjacent stones. The radial joints were so extended as to make the step not less than 4 ins. and increasing as the springing line was approached. The sheeting and ring stones were all accurately cut in the quarry, and when the keystone was set the work was found to be so accurately done as to require no additional cutting.

The stones for the sheeting are all 30 ins. deep on the radial line, except those of the first course above the spring or coping course, which are 36 ins. on the bed, with a vertical back. The width of sheeting and ringstones on the intrados is 18¼ ins. for the key, 16¾ ins. for the largest radius, 15 5-16 ins. for the next, and 13 9-16 ins. for the smallest radius. The width of sheeting at the extrados is 19⅝ ins. at the key, and 17 13-16, 17 3-16 and 19⅝ ins., respectively, for the largest, intermediate and smallest radius. The depth of ringstones on radial lines averages about 26 ins., the width of horizontal face decreasing from 17¾ ins. next the keystone to 9 ins. above the string course, and the height of vertical face increasing from 4 ins. at the third stone from the key to 19⅝ ins. above the string course. The key of the ringstones is 32¼ ins. deep, 19¾ ins. on the extrados and 18¾ ins. on the intrados. The dimensions given allow for ¼-in. joints. The faces of the ringstones have a 1-in. chisel draft along the edges, and the surface is rock-faced, with no projection exceeding 1½ ins. The intrados is bush-hammered. The stone is a gneiss found in the vicinity of Yonkers, N. Y., except that the keystones are of Connecticut granite, and the coping of bluestone from Palatine Bridge, N. Y.

In construction, the excavation for foundation showed blue mud for several feet below the surface, but under this a hard sand was reached and upon it the masonry was built. A course of about 3 ft. of rubble concrete masonry was first laid, ordinary concrete being laid to a depth of about 6 ins., and then large stones placed not less than 1 ft. apart and the concrete thoroughly rammed between them until the required height was reached. The masonry abutments were then built, as usual.

The form of the timber centers is shown in the cut. The supporting struts center on two points over the posts for purposes of wedging, while auxiliary wedges were also placed at each abutment. The centers were spaced 3 ft. apart and lagging was laid under the middle of each ringstone, leaving the joints exposed to view during construction, to permit accurate setting. The position and direction of each radial joint were then marked upon the centers with the result, as already noted, that when the arch was complete and the keystone set it was found to fit accurately in place without extra cutting. The wedges were then slightly loosened, to insure solid bearing throughout. The arch was finished with a coat of 2 ins. of cement mortar, but it has not proved entirely water-tight and a coat of asphaltum or tar would probably have been better.

The work was done under the supervision of Mr. F. S. Curtis, M. Am. Soc. C. E., Chief Engineer of the railway; Mr. H. B. Seaman, M. Am. Soc. C. E., being Resident Engineer of Construction, and Mr. F. M. Smith, Assistant Engineer. The contractor was John B. Westbrook, of New York, and Woolfolk & Sillery were sub-contractors. We are indebted to Mr. Seaman for photographs and blueprints from which our illustrations are prepared.

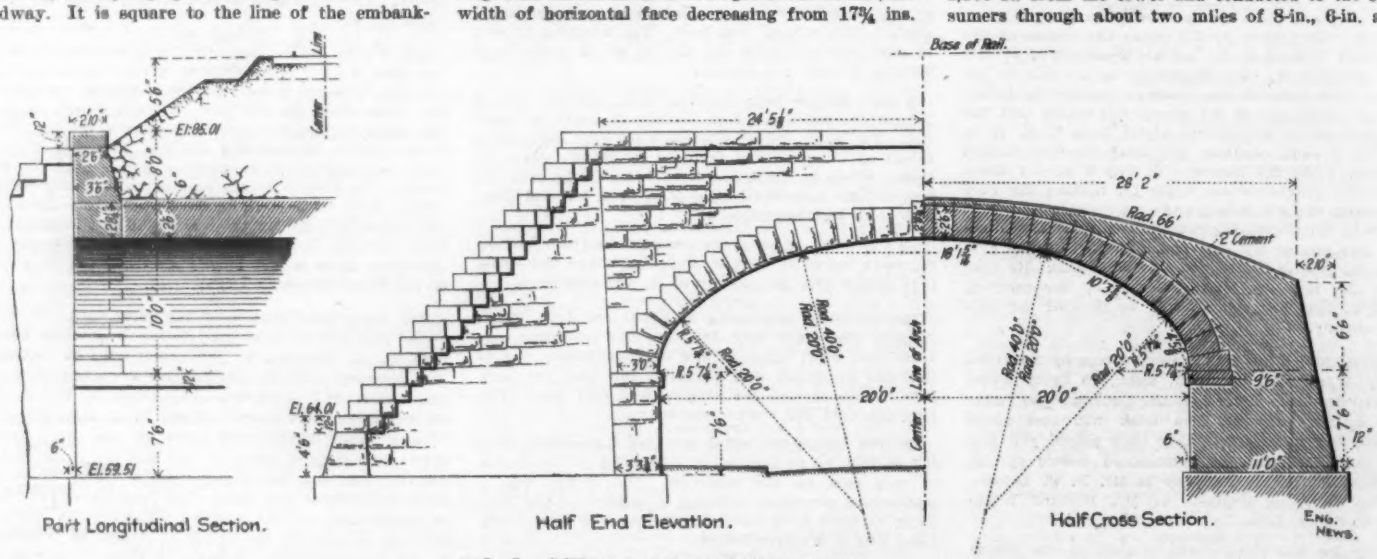


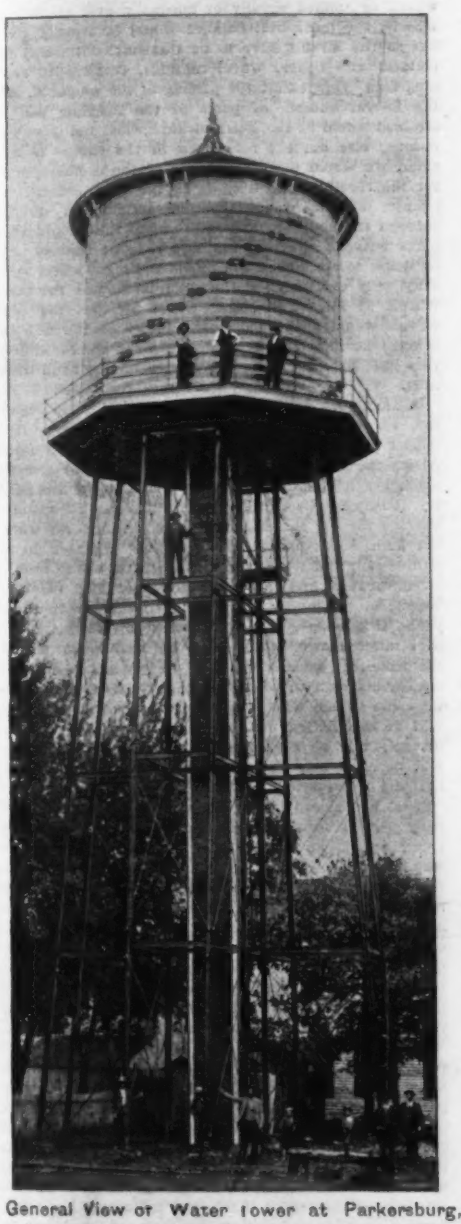

FIG. 2. DETAILS OF MASONRY ARCH.

## THE PARKERSBURG, IOWA, WATER TOWER.

The water tower shown in the accompanying illustration was designed by Mr. J. Todd for the new water-works system, built during the summer of 1893, at the town of Parkersburg, Iowa. These works cost $8,000 and were built by contract by the Challenge Wind Mill & Feed Mill Co., of Batavia, Ill. Briefly described, the water is pumped from six artesian wells, 126 ft. deep, located about 1,500 ft. from the tower and conducted to the consumers through about two miles of 8-in., 6-in. and 4-in. cast iron mains. The power plant consists of a vertical pump, with 10 × 36-in. steam cylinder and a 4-in. water cylinder, the capacity being about 3,300 gallons per hour. The tower proper is 58 ft. high and is located on an elevation about 30 ft. above the general level of the town, and the pressure afforded is approximately 50 lbs. per sq. in.

Larimer steel columns (Eng. News, July 28, 1892) are used for the tower legs, which are 12 in number and are arranged symmetrically about rectangular co-ordinates passing through the center of the tower. It may be noted here that the Larimer column has been used in a considerable number of water towers built by the above-mentioned company during the last year or two, and is stated to have proved very

satisfactory for the purpose. The four inside legs of the tower are vertical and are arranged in a square, with 6½-ft. sides. The eight outside legs are arranged in pairs, equidistant, 14 ft. 7 ins., from the center of the tower, on the rectangular coordinates, one leg of each pair standing on each side of the ordinate through that pair. These outside legs have a batter of 1 in. to the foot. The whole 12 legs are braced together with 5-in. steel I-beam, horizontal struts and ⅞-in. and ¾-in. round steel diagonals. Riveted angle connections are used for the struts, and the diagonals pass through cast iron lugs bolted to the legs, and are threaded at the ends and tightened by hexagonal nuts. Where the



General View of Water Tower at Parkersburg, Iowa, with Larimer Columns; The Challenge Wind Mill & Feed Mill Co., Batavia, Ill., Contractors.

diagonals cross, a cast iron clamp is used to hold them. The beams for the tank platform are 12-in. I-beams, with riveted angle connections to the tops of the tower legs. At the bottom the tower legs are anchored to stone masonry pedestals.

The tank is of 3-in. pine, with 20-ft. staves and 24-ft. diameter bottom. The hoops are of steel, having a tensile strength of 50,000 lbs. per sq. in., and vary in size from 6×3-16 in. at the bottom to 3×⅛ in. at the top, there being 16 hoops altogether. Each hoop, except the bottom, has three sets of lugs and bolts for tightening, and the bottom hoop has four sets. The roof of the tank is conical and is made up of 2×4-in. rafters, covered with 1-in. boards and shingled. The rafters have a one-fourth pitch, and are thoroughly tied together and to the body of the tank.

We are indebted to the contractors, the Challenge Wind Mill & Feed Mill Co., of Batavia, Ill., for the matter from which our illustration and this description have been prepared.

## RECENT REPORTS OF STATE RAILWAY COMMISSIONS.

The annual reports of the railway commissions of three States for the year ending June 30, 1894, received within the past few days, bear record to the serious effects of the period of depression through which the country has been passing, and indicate how intimate is the relation between railway revenues and the general prosperity of the country. In two of these reports a reduction in the number of accidents to employees is noted, and is attributed to the reduction in business.

### New York.

The Board of Railroad Commissioners, in its annual report, advance copies of which have recently been issued, refers to the serious financial troubles which the railway interests have had to encounter, and it is pointed out that, while the present is not a time to urge special progress in directions involving large outlay, there are three questions before the board which call for large expenditures by the companies. Two of these, the adoption of automatic couplers and air-brakes upon all freight cars, are well under way, while the third, the grade-crossing question, is not yet embodied in legislation. A comparison of the figures of the reports for 1893 and 1894, shows for the latter year a loss in gross earnings from operation of $10,399,512, or about 5%. The operating expenses have, however, been decreased $6,035,340, leaving a loss in net earnings from operation of $4,364,171, showing that reduced earnings have been more than half provided for by economy in operation. A brief summary of the business of the years 1893 and 1894 is given in the following table:

| | Year ending June 30, 1893. | Year ending June 30, 1894. |
|---|---|---|
| Gross earnings—operations | $208,356,827 | $197,957,315 |
| Operating expenses | 143,075,914 | 137,040,574 |
| Net earnings—operations | 65,280,912 | 60,916,741 |
| Income—other sources | 8,096,358 | 7,584,135 |
| Capital stock | 716,130,838 | 737,878,692 |
| Cost of road and equipment. | 1,379,257,253 | 1,411,249,576 |
| Per cent. of gross income to cost of road and equip. | 05.2 | 04.85 |
| Per cent. of net income to capital stock | 03.17 | 02.43 |
| Per cent. of dividends declared to capital stock | 02.60 | 02.69 |
| Miles of road in New York State, main line | 7,892 | 7,991 |
| Tons of freight carried one mile | 18,815,692,979 | 16,373,354,932 |
| Ave. freight earnings per ton, per mile (cts.) | 0.751 | 0.766 |
| Ave. freight expenses per ton per mile (cts.) | 0.509 | 0.537 |
| Average freight profit per ton per mile (cts.) | 0.242 | 0.229 |
| Passengers carried one mile (excldg. elevated roads) | 3,038,930,448 | 3,751,553,970 |
| Ave. earnings per passenger per mile (cts.) | 2.20 | 1.93 |
| Ave. expenses per passenger per mile | 1.55 | 1.31 |
| Ave. profit per passenger per mile (cts.) | 0.65 | 0.62 |

In accidents, there were 723 persons killed and 1,821 injured, as compared with 742 and 2,288 in 1893. The number of employees killed was 185 and injured 1,166, as compared with 306 and 1,622 in 1893, the decrease being said to be partly due to the equipment of freight cars with automatic brakes and couplers, but primarily to the reduced number of employees, owing to decreased business. The following shows the total number of passengers carried during the year ending June 30, 1894, as compared with the preceding year:

| | 1893. | 1894. |
|---|---|---|
| Steam railways | 148,349,330 | 162,957,535 |
| Elevated railways | 278,343,341 | 251,092,610 |
| Street railways | 487,064,531 | 504,070,025 |
| Totals | 913,757,202 | 918,720,170 |

The accident table shows that the total number of passengers killed during the year ending June 30, 1894, from causes beyond their control, was 29, making the remarkable average of one in each 31,680,000 passengers carried. These totals do not include the 41,221,405 passengers carried on the Brooklyn bridge (Eng. News, Dec. 20, 1894), where no passengers were killed during the year. With these figures added, the average would be one in 33,103,157 passengers carried.

The report takes up the grade-crossing question and a draft of a bill on the subject is given, but we shall deal with this matter in a separate article. The physical condition of the railways has been well maintained, in spite of the financial difficulties, and reference is made to the laying of some 70 miles of 100-lb. rails on the Hudson River Division of the New York Central R. R., which division is to be laid entirely with end rails. In regard to the block signal system in use on this road for nearly two years, and on the New York, Lake Erie & Western R. R. for more than one year, it is stated that there has not been a rear collision of passenger trains on these roads since the adoption of the system. Recommendations are made as to the operation of electric and cable cars, which recommendations were previously made in the report for 1893, and which include a wise provision for the thorough examination and training of applicants for positions as motormen.

### Connecticut.

The report of the Railroad Commissioners shows that the length of main lines and branches in the state was 1,013.22 miles, the same as the previous year. The length of second track was also the same, 233.60 miles; the third and fourth tracks had each increased 14.56 miles, making 1,275.94 miles of single track. The sidings increased to 372.80 miles, making the total lengths of tracks within the state 1,648.74 miles. The gross earnings amounted to $32,444,313, the passenger earnings being $15,296,761 and freight earnings $14,152,365, while in the previous year the freight revenue exceeded that from passengers. The operating expenses were $23,315,521, or 71.86% of the gross earnings, an increase of 1.72%. The net earnings were $9,128,793, or $3,908 per mile operated and 44.7 cts. per train-mile, as against $4,586 and 36.3 cts. for 1893. There were 53,775,945 passengers carried, the average journey being 15.62 miles and average fare 28.45 cts., or 2.31 miles and 4.73 cts. less than for 1893. The freight handled was 13,122,650 tons, the average haul being 70.18 miles and revenue per ton $1.126, or 2.50 miles and 6.1 cts. less than for 1893. The train mileage was 26,671,023, of which 12,733,679 were by passenger and 7,601,451 by freight trains. The total amount charged to maintenance of way and structures was $3,981,119, or $1.704 per mile of road and 15 cts. per mile run. Satisfactory reductions in accidents are reported: 12 passengers were injured, 2 fatally; 194 employees were injured, as against 504 in 1893, and 23 of these were killed or died from their injuries. This large decrease in injuries is ascribed to the large falling off in the freight business. At grade crossings 22 persons were injured (as against 31 in 1893), of whom 10 were killed. The report discusses somewhat fully the questions relative to the prohibition of grade crossings of steam and electric railways, but this matter we shall consider in a separate article.

On the New York, New Haven & Hartford R. R. the four tracks have been completed between New Haven and Bridgeport; and the most expensive portions of the work remaining to be done are those through Bridgeport, South Norwalk, Stamford and Greenwich. Plans have been approved for the work through South Norwalk, involving a four-track drawbridge over the Norwalk river and the elimination of all highway grade-crossings, the tracks being elevated and the streets only slightly depressed. This road has laid 23,856 tons of new rails.

### Vermont.

This report is for the two years ending June 30, 1894. The only new construction since January, 1892, has been 1.75 miles from Barre to East Barre and about four miles of second-track between St. Albans and Swanton junction. The period of commercial depression has caused a great falling off in passenger and freight receipts, and necessitated a curtailment of expenses. The cost of the 929.36 miles of standard gage track in the state has averaged $34,788 per mile, or $40,329 including equipment, while that of the 52.5 miles of narrow-gage

roads has been $13,064, or $15,154, including equipment. The general results of operation were as follows:

| | 1892. | 1893. |
|---|---|---|
| Passengers carried | 14,838,800 | 15,961,873 |
| Receipts per pass. per mile (cts.) | 2.742 | 2.776 |
| Cost per passenger per mile (cts.) | 2.205 | 2.203 |
| Tons of freight carried | 15,341,947 | 16,756,987 |
| Receipts per ton per mile (cts.) | 6.046 | 3.246 |
| Cost per ton per mile (cts.) | 2.742 | 2.400 |

The acts requiring the use of tell-tale warnings for all bridges and overhead structures having less than 20 ft. headway took effect in April, 1893, and this and the former act requiring blocking for frogs and switches have been of great good in the interests of the safety of the trainmen, and have been readily observed by the railway companies. The condition of the railway bridges of the state is speedily improving, and great progress has been made in replacing old bridges with modern iron structures. In all instances of renewal of the floor systems, or of rebuilding the bridges, the standard system of floor has been adopted, having long ties placed close together, with guard timbers boxed out for the ties, and in several cases inside guard rails have been provided. The system of heating cars by steam from the locomotive has come into use on all passenger trains, and, in regard to car lighting, it is stated that the Pintsch system of gas lighting appears to be the most approved for safety and efficiency, while coal oil at the safety test of 300° F. is still in general use throughout the state. The Board recommends legislation authorizing railway companies to take lands adjoining their lines near highway grade crossings for the purpose of removing obstacles dangerous to travel and obstructions to view of approaching trains by travelers on the highway. The bulk of the report is occupied by the returns from the railway companies.

## THE COUNTERBALANCING OF LOCOMOTIVES.

(Concluded from p. 23.)

The third paper to be considered here was the report of a committee on "Counterbalancing Locomotives," presented at the November meeting of the Southern and Southwestern Railway Club, which recorded 17 different rules for counterbalancing, all extensively used, and in this diversity, as well as in the errors of application of the rules, may be found reasons why some roads have had to increase and other roads to reduce the counterbalance weights. Each pair of wheels, or, better still, each wheel, should be independently balanced within itself for all the rotating or revolving weights attached to its crank pin. Rules vary as to how much of the main road should be considered as revolving weight and how much as reciprocating weight, but the committee considers that these should each be taken at half the weight of the rod for the usual length of rods on road engines, while for very short connecting rods, as on suburban, shifting, and Forney engines, especially when the reciprocating parts are heavy, 0.6 of the main rod should be taken as revolving, and 0.4 as reciprocating weights.

Another point to be considered in adjusting the counterbalance weights for the revolving parts is the fact that the centrifugal force of the combined weights at the crank pin does not act directly in the plane of action of the counterweights, these latter having to be set back in the wheel so as to clear the side rods; consequently there is a tendency to oscillate or wabble, when a pair of wheels is revolving, which can only be remedied by placing an additional weight in the opposite wheel directly in line with the crank and opposite the counterweight, and by proportioning this so that the sum of the weights of the main rod and opposite additional weight will equal that of the counterbalance. If the framing, wheels, etc., are designed to withstand the strains caused by steam they can certainly stand the much smaller strains caused by the weights on the crank pin not revolving in the same plane as the counterweights, but it should be borne in mind that the nearer together the planes of rotation of the weights can be brought, the less the disturbing action from this cause will be; therefore, the cylinders of an engine should not be spread one inch further apart than is absolutely necessary. The crank pins should not be made longer than is needed for sufficient bearing surface, and unnecessary collars on the crank pins between the main and side rod brasses and up against the crank hubs, which simply increase the length without answering any useful purpose, should be avoided. The counterbalance weights should also be made to project as far out from the face of the wheel as the rods will permit, with due allowance for clearance. It is a mistake to set them back in the wheels, flush with the spokes, although this is a very prevalent practice, it being a common thing to find the counterweight in a main wheel projecting an inch or more, and that in the leading and trailing wheel set back flush with the spokes. This is wrong. They should all be brought out as far as possible, and the front and back counterbalances reduced by taking the weight off the insides or length rather than off the face. If the above points are paid attention to, the disturbing force due to the different planes of rotation will be reduced to an amount too insignificant to bother further about even on heavy engines.

When we come to consider the counterbalancing of the reciprocating weights, there are four separate and distinct questions to be answered:

1. Can the reciprocating weights be correctly balanced in a horizontal direction by the application of counterweights in the driving wheels?

2. How should the amount of counterweight which is used to counterbalance the reciprocating parts be applied, all, in the main wheel? or, divided over all the wheels?

3. What portion of the weight of the reciprocating parts should be counterbalanced?

4. What influence does the steam in the cylinders have on the disturbing action of the reciprocating parts and the proper counterbalancing of these?

1.—It is first necessary to clearly understand the nature of the disturbing forces produced by the reciprocating motion of the pistons, piston rods, cross heads and front portion of the main rod. These parts acting together have a total given weight; as they change their position with every stroke, the position of their center of gravity changes relatively to the whole machine, and consequently with every movement of the reciprocating parts, the center of gravity of the engine changes position, not only fore and aft, but laterally.

At the end of the stroke, although the crank is revolving steadily, the piston is at rest; as the crank pin passes upwards, the speed of the piston increases till at half stroke the speed of the piston is equal to the circumferential speed of the crank pin; from there to the end of stroke, the speed of the piston decreases from its maximum to zero. The reciprocating weights are, therefore, being accelerated by the crank pin during the first half stroke, and retarded or held back by the crank pin during the second half. As the speed of the piston is zero at the ends of the stroke and maximum at half stroke, it follows that the rate of acceleration and retardation must be unequal. It is this acceleration and retardation which causes the disturbances we are trying to overcome and it has been shown that the effect of a counterweight placed opposite a crank will exactly counteract these disturbances in a horizontal direction, because it of itself produces precisely similar and opposite disturbances; that is, when the counterweight and reciprocating weights, act in the same plane, which they can never do, as already explained.

In a four-cylinder engine of the Shaw type, it will be found that the disturbing forces due to the reciprocating weights would neutralize each other on each side of the engine if in the same plane of action, but for locomotives of large power, to obtain a counter or overhanging crank of sufficient strength, it is necessary to place the centers of the additional cylinders considerably further apart than the centers of the inner cylinders, and we then have the reciprocating weights and steam pressures acting in different planes, thus setting up an unbalanced condition which would require counterweights to correct it. The complication, extra number of parts, and essentially weak form of this type of engine, coupled with the fact that it cannot be balanced for the reciprocating weights without some counterweights in the wheels, is the reason why these engines have never been brought into general use.

It is an utter impossibility to accurately balance the reciprocating weights by counterweights in the driving wheels, on account of the angularity of the main rod. A compromise is necessary, and we take the mean between the two, which is the best that can be done, and which is found by assuming, as before explained, that the main rod is of infinite length, and would, therefore, always be parallel with the center line of the cylinder.

2.—Practice in this respect varies very greatly. In England the counterbalance for the reciprocating weights is generally applied at the main wheel, while in this country the weight is generally distributed over all wheels. In showing that the disturbances caused by the reciprocating weights were approximately the same as the horizontal component of centrifugal action of counterweights, and could be balanced by one disturbance absorbing the other, we referred only to the horizontal component of the centrifugal force which must receive consideration. As long as the counterweights only balance the revolving weights, there could be no downward pressure on the rails, or upward pressure on the journal box caused by the vertical influence of the counterbalance; but just as soon as we begin adding weight to the wheels to perfect the balance of the reciprocating weights in a horizontal direction, we correspondingly unbalance the wheels in the vertical direction. This is unavoidable, and as far as the machine iself is concerned, theoretically it is indifferent whether the whole of the counterbalance for the reciprocating weights be applied in the main wheel or any other wheel, or applied equally or unequally over all driving wheels, the horizontal balance would be equally good, but as the strains have to be transmitted through the frames, axle boxes, wheel castings, crank pins, rods, etc., it is evident that the placing of the weight so that the fewest number of parts of the machine will be strained would be the most advantageous, and if we had nothing else but the steadiness of the engine to consider, we would place the whole of the counterbalance for the reciprocating weights in the main wheels, the counter strains would then be transmitted directly through the main pin and main rod to the reciprocating parts without affecting the side rods or frames. But by doing so we should unbalance the main wheel vertically very seriously, and not so unbalance the other wheels at all. The result would be that the main wheels would strike destructive blows on the rails and bridges at high speeds, the tire wear would also be very irregular, flat spots being worn on the main wheel tires.

In England, where large driving wheels are in general use, where the reciprocating parts are made very light indeed as compared with the American practice, and where the weight of rail and strength of bridges are much greater per ton of rolling load than in this country, it may not be objectionable to place all the counterbalance for the reciprocating parts in the main wheel, but here where much heavier engines are used on far lighter rail, and where too many bridges are in need of strengthening and renewing to meet the increased weight of rolling loads which have come with recent years, it is unquestionably proper to divide the amount of counterbalance, which is to be used to correct the disturbances caused by the reciprocating weights, equally between all wheels, so that the downward pressures due to the wheels being out of balance vertically will be distributed over as many points as there are drivers, will be correspondingly reduced in intensity, will be all equal, and consequently the rails and floor systems of our bridges will be less severely strained.

3.—It has already been shown that to obtain practically perfect horizontal counterbalancing for the reciplocating parts, an amount must be added to the counterweights which will counterbalance the entire weight of the piston, piston rod, cross head, and half the main rod. D. K. Clark laid this down as necessary in 1852, and in speaking of the vertical unbalance and the effect of this on track and bridges, dismissed this side of the question with the following words: "Its vertical action is insignificant in practice, considering that it has to contend upwardly, with the whole weight of the machine, and downwardly it is met and balanced by the rigidity of the rails." This may have been quite proper in 1852, when the locomotives were quite light and small for the tracks on which they ran, as compared with the immense American engines of to-day, and the tracks on which these run. It may be still quite proper in England to concentrate the counterbalance for the reciprocating weights in the main wheel on account of the lightness of the parts and relative strength of the tracks there, but unless we are misinformed, engines so balanced have caused much trouble on the lighter rails and imperfect tracks in Australia. In England some of the best roads running the fastest trains, where the conditions are far more favorable for full balancing than they are in this country, only find it necessary to counterbalance 50% of the reciprocating weights.

Some reports of bent rails having been sent in on a prominent Western road, an investigation was held, and it was found that additional weights had been added to the main wheels of some of the older engines by one of the master mechanics because the engine rode hard. It was found that one of these engines which had been tinkered with in this way had considerably more balance than was needed to counterbalance the reciprocating weights, and it was excessively out of balance vertically in consequence. It was further found that the rail pressures produced by this vertical unbalance would, at 60 miles per hour, amount to 34,600 lbs. for each main wheel for each revolution, and by actual drop test it was found

that this was more than enough to produce bad kinks in a new 60-lb. rail supported on ties 18 ins. apart. In the tests of this engine when slung from the cranes, it was found that the oscillation was not materially different in extent when the engine was slightly overbalanced for the full amount of the reciprocating weights, and when the weights were so reduced that only 33% of the reciprocating weights were balanced; the main disturbance in the former case, however, was fore and aft and rolling, while in the latter case it was by nosing. It was found to be unsafe, however, to run the engine in either case faster than 28 or 30 miles per hour on account of the excessive vibration of the cranes and building.

In an instance which came to the notice of your committee where the lead had been unintentionally omitted from two of the counterbalances of one engine of a group of five running in chain-gang service, careful observation failed to show that there was any perceptible difference in the riding, not one of the enginemen handling these engines noticed the absence of the lead or made a complaint of the engine. And after months of service, careful inspection showed that the engine had not suffered in the slightest in wear or otherwise on account of the omission. Again, we have positive evidence that one lot of heavy consolidation engines were sent into service with only sufficient counterbalance to balance 2% of the reciprocating weights, and were all so rough when running fast, that they shook their cabs to pieces in no time, and the men could not sit down on the cab seats. Again, it is claimed that some of the world's records for high speeds recently have been made with engines fully counterbalanced for their whole reciprocating weights. This is no doubt true, but it must be remembered that the tracks on which these engines are run are exceptionally heavy for this country, and until the question as to whether these same engines would not make faster time with greater ease if the counterbalance is reduced, we must allow that the weight of the evidence is against full balancing on modern heavy engines. One of your committee knows from personal experience that some of these fully-balanced engines, running at 70 miles per hour and over (while there was little lateral oscillation) are exceedingly rough riders, jarring the spine so that at the end of a long run one is in a state of abject collapse. Taking everything into consideration, your committee believes that the weight of the testimony is against the practice of providing full balance for the full reciprocating weights. That on locomotives of the design and weight prevalent a few years ago, probably the best proportion of the reciprocating weights to balance is about two-thirds, and the same rule can be followed with engines having an exceptionally small wheel base and long overhanging ends, such as shifters for use on sharp curves. That for modern locomotives of heavier designs for road service it is believed that to provide counterbalance for 50% of the reciprocating weights will give a good riding, well-balanced engine, which will not be so severe on the tracks and bridges at high speeds, and the tires of which will wear more evenly. But that with compound engines, having excessively heavy reciprocating parts, as compared with their total weight the proportion of reciprocating weights to be counterbalanced should be between 60% and 75%, according to circumstances. Incidentally we found a variation of 24 lbs. in the finished weights of 20-in. pistons cast from the same patterns.

4.—All locomotives have to make a good portion of their mileage drifting down grades with steam shut off, and the balance must be so arranged that the engine will run smoothly under these conditions as well as when steam is being used. For a well-designed modern locomotive the disturbing influence of the reciprocating parts at the highest speeds is not much over half the pressure in a horizontal direction that is exerted by the steam along the same lines of action. With short cut-offs there are times when the steam works against the disturbing force, and others when it works with it, and these conditions vary constantly, according to the cut-off and throttle opening at any particular rate of speed. It is an interesting study to represent by diagram the rotative effect of the crank circle at every degree of the revolution due to the action of the steam and reciprocating parts, but it is too elaborate an investigation to bring into this report. Suffice it to say that for short cut-offs, such as are used at high speeds, the acceleration of the reciprocating parts comes into play much as a flywheel does in a stationary engine to regulate the turning moment on the crank axle; and generally speaking, the action of the steam helps to cushion and distribute the disturbing action of the reciprocating parts, as also to take up the slack gently at the proper times and prevent heavy pounding, especially when the compression line of the indicator diagram is well adjusted, but the steam cannot counterbalance the disturbing effects of the reciprocating parts; it simply modifies their effects. It is too often the case that engines are reported riding roughly and needing more counterbalance, when the fault is in the defective valve motion, excessive or insufficient compression, too much lead, or some similar troubles, and the counterbalance should not be interfered with until indicator diagrams have been taken from the engines and the valve motion adjusted so as to give a proper exhaust, compression and pre-admission for the conditions under which the engines are expected to work. This is rarely done, but instead the master mechanic commences to tinker with the counterbalances, adding and taking off weights by guess-work until the engineman is satisfied, when as often as not they have been trying to correct a bad steam distribution by spoiling the counterbalancing.

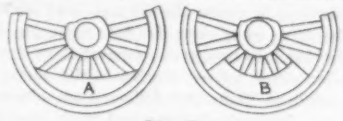



Fig. 7.

The report may be summarized as follows:

1. Each wheel should be balanced correctly for all the revolving weights attached to it.

2. The main rod should be considered as half revolving and half reciprocating weight when over 8 ft. long; if under this it should be considered as 0.6 revolving and 0.4 reciprocating weight.

3. The part of the weight of the main rod considered as revolving weight should be entirely balanced in the main wheel.

4. The amount of overbalance to be applied to the drivers to balance the reciprocating weights should be equally divided between all the driving wheels.

5. For modern heavy well-designed locomotives, with comparatively light reciprocating parts, provide counterbalance for 50% of the reciprocating weights.

6. For lighter engines, that are less able to withstand strains, and absorb the disturbances caused by heavy reciprocating parts, or for such as have very short wheel base and long overhang, balance up to 66% of the reciprocating weights.

7. For compound engines, with large pistons and excessively heavy reciprocating parts, balance up to 75% of the reciprocating parts.

8. The center of gravity of the counterbalance weight must be opposite the crank.

9. The counterbalance should be brought out from the face of the wheel as far as due clearance for the rods and good design of wheel will permit.

10. The center of gravity of the counterweight should be placed as near the rim as possible, and the bulk of the counterbalance made as small as possible. This can be accomplished by the use of lead filling, and by making the counterweights as at A, rather than as at B, Fig. 7.

11. If, on account of the smallness of the wheels, sufficient counterbalance, according to the rules given above, cannot be placed in the main wheels, then add up to 50 lbs. to the weight in each of the other wheels to help balance the right amount of the reciprocating weights, but the excess should in no case exceed this amount.

12. Make the reciprocating parts as light as possible.

In the discussion on the paper by Prof. Goss, given last week, Mr. Geo. S. Morison said it is important to eliminate from track and bridges the great variation in pressure due to faulty counterbalancing. Mr. Strong said that, even when the wheel is not lifted from the track, there is the effect of a blow. The variation in pressure may decrease the traction and give the wheel a tendency to slip. Another member said that he believed fully one-third of the repairs to engines and wear and tear of track are due to unbalanced reciprocating parts. Mr. F. W. Dean said he had noticed, in riding on engines, much vertical vibration, which he could account for only by the wheels leaving the track. Below and above a speed of 60 miles an hour this vibration was not noticeable. He further stated that Mr. Strong has made studies for an engine which appears likely to overcome vibration perfectly. Mr. M. N. Forney said he, also, was designing a locomotive to overcome the difficulties under discussion. He thought it was fair to infer from Mr. Goss' paper that the engine in question was overbalanced.

Mr. Morison stated that on railways passing through hilly country almost all bent rails are between two hills, where the highest speeds are attained. Mr. Strong confirmed this statement and referred to a rolling motion of the locomotive, which causes the bends to be down and in, the bends never being outwards.

In the discussion on Mr. Barnes' paper, on "Railway Locomotive Driving Wheels," abstracted last week, Mr. Strong said that Mr. Barnes' method of overcoming the difficulty is by reducing the weight of the reciprocating parts and by large driving wheels. Fast trains must have engines with high piston speeds, which require heavy reciprocating parts. Mr. Strong thought that for American roads 5-ft. wheels are better than 7-ft. wheels. The cost of locomotives is nothing compared with the expenses caused by bad track, resulting from poor balancing. In response to a request from the President-elect, Mr. Davis, Mr. Strong gave a brief description of his new locomotive, soon to be tested. It will be a four-cylinder balanced engine, with a crank shaft of nickel steel. In a later issue we shall give particulars of some three-cylinder balanced locomotives.

MAPS SHOWING IMPROVEMENTS TO THE WATER SUPPPLY OF LOS ANGELES, CAL.

## THE NEW WATER SUPPLY OF LOS ANGELES.

By Wm. Mulholland, Superintendent Los Angeles City Water Co.

The rapid growth of the city of Los Angeles has made necessary a considerable extension of its system of water supply. The accompanying sketch map will show the main features of the improvements which are now being made by the Los Angeles City Water Co. As shown by the map, the principal portion of the city is located to the south and east of a group of hills which project from the main range of the Santa Monica Mts.

and form the west boundary of the valley of the Los Angeles River.

When the water-works were first constructed, in 1868, the center of population was about 7,000 or 8,000 ft. southwesterly from the old Buena Vista St. reservoir, and the conduit supplying it was constructed on an easy and fairly direct contour from the source of supply, which was at that time the Los Angeles River direct, which has since been supplanted by water obtained from infiltration galleries built in the marshy tract adjacent to the old point of diversion from the river.

Within the last few years the city has been growing rapidly towards the south and west, and the largely increased draft of water in that direction has seriously affected the pressure on the mains in the business portion of the town, rendering the service in the high buildings very unsatisfactory.

The question resolved itself into whether it would be cheaper to enlarge the old conduit and pipe system, with its consequent tearing up of paved streets, or depart from the old conduit by a tunnel, as shown, and come down the westerly boundary of the city, to meet the direction of the new growth, and what will, in all probability, remain the direction of future increase in population.

The feature that finally decided our course was the one of reservoir sites. The old reservoir was altogether too small for a city as large as Los Angeles, and as it was the only available site on the old line along the bluff northeasterly slope of the hills, we determined to adopt the new route, which affords a choice of several fine sites, the one shown being selected for construction the coming spring.

This will have an elevation of 380 ft., against 375 ft. for the old one, and will be connected directly with the old distributing system by a 30-in. main, means being, of course, provided to prevent the water backing into the old reservoir when the consumption is light.

The pipes in the distributing system in the business portion of the city will, therefore, be supplied from both directions, which will greatly increase their efficiency during periods of heavy draft.

Our pumping station, being located at the old reservoir, will continue to draw its supply from there. This station supplies all the water used above the 300-ft. contour, which amounts to about 2,000,000 gallons daily during the maximum period in summer. We get about 1,000,000 gallons daily from springs in the Arroyo Seco, which is consumed on the east side of the river, a district at present comparatively thinly settled.

## EXPRESS LOCOMOTIVE; PENNSYLVANIA R. R.

(With inset.)

The great weights and high speeds of many of the passenger trains on our leading railways have necessitated the design of special locomotives for this class of service,and we show,on our inset sheet, this week, the plans of the latest type of express locomotive of the Pennsylvania R. R., for which we are indebted to Mr. Theo. N. Ely, Chief of Motive Power. Several roads have adopted the ten-wheel type of engine for such service, but the "Class P" engine of the Pennsylvania R. R., shown herewith, is of the eight-wheel type, with large cylinders and driving wheels. This class of engine was designed particularly for hauling the heavy express trains on the New York division, but is used also on other divisions where similar service is required. A complete list of dimensions was given in our issue of Jan. 3, but we repeat some of the leading particulars, as follows:

| | |
|---|---|
| Driving wheels, diameter | 6 ft. 8 ins. |
| " wheelbase | 7 " 9 " |
| Weight on driving wheels | 87,300 lbs. |
| " per wheel | 21,825 " |
| " on truck wheels | 39,750 " |
| " total of engine | 127,050 " |
| Cylinders | 19 × 24 ins. |
| Boiler, diameter | 4 ft. 9 ins. |
| Boiler pressure | 175 lbs. |
| Firebox, size inside | 9 ft. 11⅝ ins. × 3 ft. 4 ins. |
| Grate area | 33¼ sq. ft. |
| Tubes, 258; diam. inside, 1⅝ ins.; length, | 11 ft. 4 ins. |
| Heating surface, tubes (exterior) | 1,435 sq. ft. |
| " " firebox | 148 " " |
| Exhaust nozzle | 5¼ ins. |
| Height from rail to top of smokestack | 15 ft. |
| Capacity of tank | 3,000 gallons. |
| Capacity of coal space | 15,000 lbs. |

The pistons are dished, and care seems to have been taken to ensure lightness in the reciprocating parts. Three-bar guides are used, the top bar being the full width over the two lower bars, and the flat cross-head having a projection passing down between the lower bars, which carries the piston-rod head and the wrist pin for the connecting rod, as in the Laird guides. The driving wheels have elliptical springs hung under the boxes, while the truck has double helical or coiled springs. Two brake reservoirs are placed in front of the cylinder saddle and the "pull" driving-wheel brakes are operated by a vertical cylinder, 10×8 ins., under the cab. The truck is fitted with "spread" brakes, operated by a horizontal cylinder, 8×7 ins., placed on top of the back end of the truck frame.

The firebox is above the frames, and carried up at the back, so as to clear the rear axle, the ashpan being divided into two parts, separated by this axle. The boiler check valves are inside the shell, which is an excellent plan, not followed as often as it should be. Instead of the usual push bar on the front of the pilot, there is a regular automatic coupler head projecting well forward and supported by two rods from the top of the bumper beam. The smokestack is 13½ ins. diameter at the throat, a little above the smokebox shell, and flares upward to a top opening 16½ ins. diameter, while downward it spreads out into a bellmouth projecting inside the smokebox.

The smokestack and casings of dome, sandbox and safety valves have a somewhat English appearance, and this is especially true of the dome casing substituted for the usual style having more or less molding, but these features are merely indications of a tendency towards extreme simplicity of appearance, which has been in evidence during the past few years. The headlight is somewhat of a novelty, being a circular lantern attached to a bracket bolted to the top of the smokebox. Wheel covers or splashers are placed below the running board, but the common Pennsylvania R. R. practice of placing the sandboxes in the front of the wheel covers is not followed, for the reason, it is said, that the sand was found to pack in the boxes and not to flow freely. The sand flows down by gravity, no air or steam jet being used, and the mouth of the sand pipe is led close to the wheels. The boiler head extends nearly to the back of the cab, and a somewhat unusual feature of the cab is that it is closed at the back, having doors at both sides of the back, and a partition extending from above the firedoor to the roof of the cab, with a handhole in the partition, so that the end of the throttle rod can be got at without taking off the partition. The arrangement appears somewhat awkward, especially for the fireman, and the step to reach the cab from the tender footplate seems to be small and inconvenient. The engine has no footplate, and the front of the tender comes close up against the boiler head. Most master mechanics, however, prefer the arrangement in which the cab extends back beyond the boiler head, as in the engines shown in our issues of July 6, Oct. 12 and Nov. 9, 1893.

## PROGRESS IN REMOVING GRADE CROSSINGS.

As most of our readers know, Connecticut and Massachusetts have been for some years at work on the problem of the elimination of grade-crossings of highways and railways,and the movement in this direction has received considerable impetus through the rapid extension of electric railways. It is bad enough to have a much-used public street crossing at grade a two-track or four-track steam railway; but the risk is much increased when an electric railway runs along the street, for the trolley is apt to jump the wire when the car jolts over the crossing frogs, and the delay in replacing it and getting under way may prove fatal, as trains on the steam railway cannot, of course, approach such crossings "under control."

In some cases interlocking signals and derails are used (Eng. News, Feb. 22, 1894), as at grade crossings of steam railways, but the first cost is considerable and there is a constant expense for wages of signalmen and maintenance of plant. Wherever there is heavy traffic it is far better that the grades should be separated. This view is coming to be generally accepted, as shown by the instance noted in our issue of Sept. 13, 1894, and by the recent action of state Boards of Railroad Commissioners, which is summarized below:

In Connecticut, 27 grade crossings were eliminated during the year ending June 30, 1894, 26 of which were on the New York, New Haven & Hartford R. R. In two cases permission for street railway companies to cross steam railways at grade was refused, unless the street and steam railway companies would sign agreements to put in interlocking signals and derailing switches, and in neither case was such agreement effected. The Bridgeport Traction Co., however, secured special legislation authorizing it to cross steam railways at grade, and the Board of Railroad Commissioners, therefore, required that the rails should not interfere with those of the steam railway, that the trolley wires should be at least 22 ft. above the rail, and that the conductor of each car should go ahead with a red flag or lamp and signal the motorman if the crossing was safe. A curious and interesting case was that in which a spur track was proposed from the Danbury & Berkshire line to the Standard Oil Co.'s works, crossing the tracks of the Norwalk Tramway Co. The report of the Board states that the latter company opposed the crossing:

> Developing a view of such crossings on the part of an electric railway company entirely at variance with the views expressed by the representatives of such companies when asking to cross the tracks of steam railway companies. Were the danger of allowing the crossing of an electric road by a spur track of a steam road, with the infrequent use incident thereto, anything like that which was claimed in this case, no sane man would be found who would advocate the construction of an electric road at grade over the main tracks of a steam road.

Believing that the danger in this case was greatly exaggerated, the crossing was allowed by the Commission, on terms agreed upon by the two railway companies.

In the annual report of the Board (reviewed in another column), it is stated that grade crossings of steam railways by electric railways have been steadily opposed, the Board being satisfied that such crossings ought not to be allowed, except under the same regulations for safety as would be required for grade crossings of two steam roads. It is stated that as early as 1849 in the general act relating to railway companies, it was provided that all railways should cross over or under highways, except by special permission of the Railway Commissioners. For 30 years, however, the restriction was practically a dead letter. By acts of 1870 and 1883 the construction of highways to cross railways at grade was prohibited, and since 1883, practically, no grade crossings of highways by railways have been authorized. The Board thinks that, in place of adopting stringent rules, it would be far better to absolutely prohibit the crossing of street and steam railways at grade, and that not only the municipality but also the state, as well as the two companies should be included in the apportionment of the expense of the separation of grades. We quote from the report as follows:

> Action of some kind should be taken at the next session of the legislature, as no question more affecting the public safety is likely to be presented. The near future is to see a greatly increased demand for electric roads in our state, and they cannot serve the purposes for which they will be demanded without crossing and recrossing our railways; and these crossings ought to be permitted, but only upon the same conditions of safety as new highway crossings are permitted—upon separated grades. Upon no other corporations have greater public privileges been conferred than upon these companies for the building of electric roads, and the number wishing incorporation and the rush with which such roads are being constructed indicate how profitable they are expected to prove. It cannot, therefore, be regarded as unreasonable that they should comply with all requirements of public safety, than which none can be greater than the separation of grades at crossings of steam roads. When this separation is effected by taking the electric road without the highway over or under the steam road the expense should fall on the electric company, as it would fall upon a steam railway under like circumstances, but when the highway is also changed, then, following the analogy of our present laws for the elimination of grade crossings and highways and steam railways, the expense ought to be apportioned as above suggested; but in any event let there be no more crossings at grade.

The report of the Railroad Commissioners of New York for the year ending June 30, 1894, contains the draft of a proposed bill to regulate the construction of grade crossings and includes a section prohibiting electric railways from crossing steam railways at grade. This bill provides that

all railways hereafter built must be so constructed as to avoid all public crossings at grade, except as authorized by the commissioners, and any new street to be constructed across a railway must pass over or under, unless the permission of the Commission is obtained to cross at grades. When a highway crosses over or under a railway, the bridge and abutments must be maintained by the railway company, and the approaches and paving by the municipality. When a new railway crosses an existing highway above or below grade the company must bear all the expense, but when a new street crosses an existing railway above or below grade the company and the municipality must each bear half the expense. Whenever a change is made in an existing crossing, the company is to pay 62½% of the expense, the municipality 25% and the state 12½%. The commissioners would also be empowered to require changes to be made in existing crossings when they consider that public safety requires such changes. The clause relating to electric railways provides that all new lines of this character must cross steam railways above or below grade, at the expense of the constructing road, and when there is an electric railway on a crossing to be changed the 62½% of the expense above noted as to be paid by the steam railway company must be apportioned between the steam and electric railway companies, as directed by the commissioners.

With regard to the operation of existing crossings, the Board recommends legislation to compel all electric cars to stop, or to provide for interlocking switches and signals, as at steam railway crossings, while the law should also provide that at highway crossings in suburban districts there shall be signboards to warn people of the presence of such electric or cable roads. The following is an extract from advance sheets of the report:

During the year 95 persons were killed and 95 injured at grade crossings. It is still clear to the Board that in case of new railway construction no grade crossing should be permitted, but the constructing company should in every instance build over or under the highway. New highways, on the other hand, are and will continue to be often laid out across an existing railway whose grade is established, and which may have been in operation for a long term of years. In such cases there arise the questions whether the company should bear any part of the expense of carrying the highway under or over the steam road, and whether the towns, villages or cities in which the street or highway may be laid out should bear any part of such expense? In its report of last year, the Board expressed itself upon this phase of the subject as follows:

After a careful consideration of the question, the Board is of the opinion that the expense should be borne by both interests. The railways admit that they should bear part of the expense. It remains to determine what proportion. The Board is of the opinion that half should be borne by the roads, in view of the franchise rights they enjoy, of the danger to the public incident to the exercise of those rights, of the increased protection to their property which would result from under or over crossings, of the advantages gained by not being compelled to lessen speed, and of the diminution of the pecuniary liabilities as the result of such crossings. On the other hand, the communities through which they pass are greatly benefited, and the properties of such communities are increased in value by the roads. The expense incident to such great benefits should be borne in just proportion by the interests benefited. The imposition of half of the expense upon the town, village or city would operate as a check on the unnecessary opening of streets and highways.

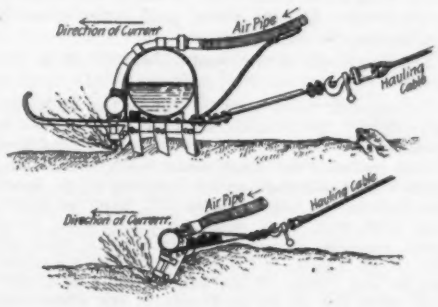
In drafting the bill which is submitted with this report, the Board has proceeded upon the theory that some of the questions connected with this subject cannot be satisfactorily predetermined or adjusted, and questions of this class have been disposed of by providing that the courts shall pass upon them in whole or in part. The Board renews its recommendation that the nature and cost of the construction under or over railway property in certain cases must be fixed by a commission of three, to be appointed by the courts. Of these three, one should represent the railway, one the town, village or city, and one should be a competent civil engineer. The Board has always recognized that the improvement involved in a general abolition of existing grade crossings is one of great magnitude, and for that reason has always suggested that it should be carried on gradually rather than rapidly. It is, however, desirable to embody the proposition in legislation and to make a beginning. The Board is also of the opinion that where an electric railroad proposes to cross an existing steam railway, there should not be a grade crossing, and has incorporated a section in the bill with this view.

The importance of this question of the crossing of electric and steam railways is emphasized in the report of the Board of Railroad Commissioners of Massachusetts, for the year 1893, which showed that, while horse railway crossings had decreased from 90 to 33, electric railway crossings had increased from 26 to 100, which condition of things had crept in under laws enacted before the operation of street railways by mechanical power had come to be considered as more than a remote possibility. The Board considered that no peril to railway travel was so serious as that involved by these crossings.

## DREDGING WITH COMPRESSED AIR.

The illustrations here given, and taken from "Le Genie Civil," shows a compressed-air dredging apparatus lately devised by Mr. Moormann for use upon the channel of the lower Weser River. A Mr. Wheeler, says our contemporary, first experimented in this direction in 1893, in removing mud from the port of Tilbury. He based his original deductions upon the fact that in dredging there are two distinct operations, the loosening of the material from its bed and its removal. In fine materials, like mud or sedimentary matter, which can be carried in suspension by the current, this current is often depended upon to transport it after it is artificially stirred up. But the velocity of transportation is often feeble, depending upon that of prevailing currents; and the distance of transportation depends upon the height to which it is possible to lift the solid particles in the stirring process.

With this in view Mr. Wheeler made a series of experiments at Tilbury, founded upon the theory that the resistance to gravity, for any particle transported in a current of water, was proportional to the velocity of this current; and that in




Compressed Air Dredging Apparatus.

a vacuum, with an initial horizontal velocity given to a particle, the distance to which the particle would be carried was proportional to the square root of the height at starting, as the path would be parabolic.

It was then evident that in attempting to remove mud by stirring, when there was little natural current, it was essential to lift the mud particles artificially as high as possible. At Tilbury a water jet was used for this purpose; but on the Weser compressed air was applied to this end as here shown.

The apparatus itself was extremely simple, consisting of a plow and an air conduit. This plow, for mud of very little consistency, was built of light iron, and was provided with a cylindrical float which prevented it from sinking into the mud beyond a certain depth. It was equipped with a series of plowshares and drawn by a cable worked either from the bank or drawn from a boat. While it is moving, air is forced into a pipe fixed upon the rear of the carriage and provided with several vertical nozzles. As this air escapes from the nozzles it agitates the water up to the surface, even in depths of from 23 to 26 ft., and gives an impulse to the water particles that is felt for "several kilometres" of distance in a very feeble current.

When the bottom is of stiffer mud the number of shares on the plow is reduced and the float is replaced by a load of castings or a block of stone. This apparatus is claimed to possess important advantages over the floating dredge, especially when employed at sea, because it can be advantageously used in stormy weather and rough water, when the ordinary dredge would be entirely unavailable.

As to the choice to be made between water-jets and compressed air, the inventor prefers the latter. Not only are the air-compressors and conduits required less cumbersome than if water were used for the same work, but the air leaving the nozzles, besides acting upon the loosened mud on the bottom, has a tendency to lift the muddy particles towards the surface, and thus increase the distance of transport. The effect of the water-jet is almost wholly expended upon the bottom material, and comparatively little power is left to aid in transport.

In the Tilbury experiments, made with the water-jet, it is said that the jet apparatus replaced, in work done, three strong dredges, and realized an economy in expense of 75%. No analogous comparison has yet been made with the Weser compressed air machine, showing its advantages as compared with the water-jet.

## LEGAL DECISIONS OF INTEREST TO ENGINEERS.

### Right of Abutting Owner.

Ejectment cannot be maintained by an abutting owner against a railway company operating its road on his half of a public street under permission from the city, he having no present right of possession, of which he has been deprived. A railway operated in a public street imposes no greater burden on the abutting property by carrying freight than by carrying passengers only.—Montgomery v. Santa Ana & W. Ry. Co. (Supr. Ct. of Cal.), 37 Pac. Rep., 786.

### Rates Charged by Water Company.

Where a contract by a water company with a city provides that water for dwellings shall be furnished at certain yearly rates, depending on the size of the dwelling, and water for other purposes at rates to be fixed by measurement, there is no occasion for a court of equity to determine what rates are reasonable. A building, the first floor of which is used as a store, the second as offices, and the third as sleeping apartments for single men, is a "dwelling," within the meaning of the contract, to the extent of the rooms occupied as sleeping apartments.—Smith v. Birmingham Water-Works Co. (Supr. Ct. of Ala.), 16 So. Rep., 124.

### Interpretation of Contract as to Implied Warranty.

A company contracted with a city to do certain paving, the expense to be assessed against the abutting property. The city agreed to turn over to the company all assessments paid into its treasury, and to assign the remaining assessments to the company, which agreed to accept the same in payment of the amount due, with the further stipulation that "the city shall not be otherwise liable under this contract, whether the said assessments are collected or not." After both parties had complied with the contract, the statute authorizing the assessment was adjudged unconstitutional, and the company was unable to collect the sums unpaid. It was held, that the contract gave rise to no implied warranty that the city had power to make the assessment, and it was not liable for the balance of the contract price.—Barber Asphalt Paving Co. v. City of Harrisburg, 62 Fed., 565.

### Abuse of Discretion in Grant to Street-Railway Co.

The board of chosen freeholders of the county of Cumberland, by resolution, granted to a street-railway company the right to lay its tracks on the center of Commerce St. bridge in Bridgeton (which bridge was built and maintained by the board), and to run its cars thereon. It clearly appeared that, owing to the narrowness of the bridge, no ordinary vehicle could pass on either side of the cars while crossing; so that, during the passage of the cars, no such vehicle could cross in the opposite direction. Such resolution was invalid, either because the board had no power to pass it, or because, if the board possessed such power to consent to a use of such a bridge by a street railway, the grant of such an exclusive use was, under the circumstances, unreasonable, and a plain abuse of the discretion committed to the board.—Elmer v. Board of Chosen Freeholders (Supr. Ct. of N. J.), 30 At. Rep., 475.

### Rights of Taxpayer in City Contract.

Under the statute providing that cities of the third class shall award all contracts for printing to the lowest bidder, the performance of such a contract, if awarded to one who was not the lowest bidder, will be enjoined at the instance of a taxpayer, where the council merely finds that the one to whom the contract was awarded was the "lowest and best bidder," without finding any facts which rendered another who was apparently the lowest bidder, not the lowest bidder in fact. Where the lowest bidder for city work which is required to be awarded to the lowest bidder is also a taxpayer, he may sue as a taxpayer to enjoin the performance of a contract awarded to a higher bidder, though his action is prompted by other considerations than his liability to excessive taxation.—Times Pub. Co. v. City of Everett (Supr. Ct. of Wash.), 37 Pac. Rep., 605.

### Action by Material Man on Bond of City Contractor.

A person furnishing materials to one under contract with a city to build a sewer, and within 90 days after its completion to pay all sums of money due at its completion for materials used on said work, cannot sue on the bond given by the contractor for the faithful performance of his contract with the city, unless the bond was made for the direct and primary benefit of such material man.—Parker v. Jeffrey (Supr. Ct. of Ore.), 37 Pac. Rep., 712.

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The prizes offered by Engineering News Publishing Co., for the best graduating theses submitted by graduates from engineering schools in 1894, have been awarded as follows:

The first prize of $75 is awarded to the thesis entitled, "Report of a Test on a New Design of Electric Railway Power Station."

The second and third prizes, of $50 and $25 respectively, are divided equally between two theses entitled, "Some Comparative Tests of Building Stones" and "The Effect of Freezing on Cements and Cement Mortars." This disposition is made because the judges find them to be, on the whole, so equal in merit that their authors are deserving of substantially equal reward.

Honorable Mention, accompanied in each case by two years' paid subscription to Engineering News, is awarded to the following theses:

1. "The Friction of Wood upon Wood at High Pressures and Its Application to the Design of Timber Joints."

2. "The Relative Tensile and Adhesive Strength of Cement."

3. "The Hydraulic Jump."

For the special prize of $100, offered for the best post-graduate thesis, no theses were offered in competition and it is, therefore, not awarded.

The names, addresses and colleges of the authors of the above theses are given in the following letter from Mr. Francis Collingwood, Secretary American Society of Civil Engineers, who received the theses and retained the accompanying data as to authorship, until our report to him of the awards:

To the Editor of Engineering News:

Sir: Replying to yours of Jan. 8, respecting the names of those to whom prizes have been awarded in the "Engineering News Thesis Competition," I would say the names sent me as the authors of the paper receiving the first prize, entitled "Report of a Test on a New Design of Electric Railway Power Station," are George Wetmore Colles, Jr., Hoboken, N. J., and Edward Beach Gallaher, of New York city, graduates of the Stevens Institute of Technology.

Prizes Nos. 2 and 3 you state are to be divided between two papers. One entitled "Some Comparative Tests of Building Stones," is by Coles A. Raymond, of Wauseon, O., and Edward W. Cunningham, of Urbana, graduates from the State University of Ohio. The other is on the "Effect of Freezing on Cement and Cement Mortars," by Percy L. Barker, of Milford, N. H., and Henry Alland Symons, of Hancock, N. H., graduates from the Thayer School of Civil Engineering, of Dartmouth College.

Honorable mention you state is awarded to (1) the paper entitled "Friction of Wood upon Wood at High Pressure, and its Application to the Design of Timber Joints." I have no envelope with such a title among those accompanying the theses; (2) "The Relative Tensile and Adhesive Strength of Cement," by Messrs. Louis J. Affelder, of Allegheny, Pa., and Robert C. Brown, of Pittsburg, Pa., graduates from the Western University of Pennsylvania; (3) "The Hydraulic Jump," by Robt. Ferriday, of York, Livingston Co., N. Y., a graduate of Lehigh University.

Yours truly, F. Collingwood,
Secretary, Am. Soc. C. E

127 E. 23d St., New York city, Jan. 10, 1895.

If the professor who sent the thesis awarded the first Honorable Mention will kindly send us the name, address and college of its author, they will be announced in our next issue.

We greatly regret the delay which has occurred this year in examining the theses and making the awards; but it has been due to causes which were unforeseen a year ago.

The theses which were sent in in competition for the awards announced above, deserve high praise for their uniform excellence; and some of them especially show an amount of labor and painstaking study and research that entitles their authors to great credit. We shall begin the publication of the prize theses at once.

---

The Engineering News Publishing Co. offers the following prizes for the best graduating theses presented by students graduating in 1895 from any engineering course of any college in the United States or Canada:

For the best graduating theses (under the conditions below stated), first prize, $75; second prize, $50; third prize, $25.

For such other theses as may seem to deserve such recognition Honorable Mention, accompanied in such case by two years' paid subscription to Engineering News.

The conditions of the competition will be as follows:

1. Competing theses must be sent by the college authorities, not by the authors. They must be sent in anonymously, both as to author and college, indorsed on the outside "For Engineering News Thesis Competition" and addressed to the Secretary of the American Society of Civil Engineers, 127 East 23d street, New York city. They must be accompanied by a sealed envelope, indorsed on the outside with the title of the thesis, and containing within the name, address and college of the author, and a certificate from some one of his professors to the effect that the thesis has been examined and is indorsed as in all known respects worthy of entering such a competition. These sealed envelopes will be retained by the Secretary, and will be opened by him after the awards are reported to him. It is particularly requested that all marks or words giving any clue to the origin of the thesis be erased so far as possible.

2. The examinations and awards will be made by the editors and associate editors of Engineering News, assisted by such experts in the several branches of engineering as they may select to aid them in reaching a just decision.

3. The basis of selection for prizes will be the same as that used in selecting papers for publication in engineering journals or the proceedings of engineering societies; that is to say, theses will be graded according to their apparent permanent value for the advancement of engineering practice or theory, either as records of original research or as intelligent and concise discussions or critical summaries of older researches. Clearness, conciseness and care in summarizing conclusions will be essential merits for a high award.

4. The right is reserved of withholding any or all premiums, in case no theses of sufficient absolute merit to deserve them shall be received. No thesis not deemed worthy of publication in full will be awarded any premium.

5. Except for special reason stated in the professor's certificates above referred to, not more than three of the graduating theses of any one college shall be entered for the competition.

6. The right of first publication of all theses awarded prizes or honorable mention is reserved to Engineering News, and all theses receiving prizes will be so published.

7. No thesis which has been previously published in full or in substance will be eligible for the competition, nor any in which due credit is omitted for any part of the thesis not original or for work recorded therein not performed under the author's direction, excepting such facts as are of common knowledge and record.

8. All theses competing for these prizes should be sent in on or before Aug. 1 to insure consideration, though this date will not be rigidly insisted upon.

9. All theses receiving neither prize or honorable mention will be returned to their authors. The manuscripts of the selected theses will belong to Engineering News, but the drawings will be returned after publication.

Circulars containing the above announcement will be mailed to every engineering school of which we have the address. If, by any chance, any college should fail to receive them, it will confer a great favor upon us by advising us of that fact, and copies of the circular will be sent to it and also to any other person interested, on request.

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An important decision in relation to the mechanical filtration of water has just been rendered by Judge Wallace, of the U. S. Court of Appeals. The use of alum or similar coagulants in water filters has been decided to be an infringement upon a patent owned by the New York Filter Co., provided the alum is admitted to the filter simultaneously with the passage of water to the filter. Where the combined coagulant and water pass to a settling basin before going to the filter, the decision states that there is no infringement. The patent in question was issued eleven years ago to Isaiah Smith Hyatt, and has been the subject of legal contention ever since the use of mechanical filters got well under way, in 1887. The history of the case and the main points in the decision are given elsewhere in this issue.

Although the original patent did not name alum as the coagulant, it was broad enough to include it and the company holding the patent adopted it to the exclusion, practically, of all other coagulants. In fact, alum proved to be so far superior to other chemicals, that one company after another has also adopted it, all of them, it now appears, thereby becoming infringers on the Hyatt patent, except such as employ settling or precipitating basins before filtration.

It is extremely fortunate for the manufacturers of mechanical filters that the question so long at issue has finally been settled, for the recent litigation has been coincident with a new and proper appreciation of the value of ordinary sand filter beds and many possible purchasers of mechanical filters have turned completely away from them and to sand filtration, on account of the possible legal difficulties in which they might become involved if they used a mechanical filter. But this decision affects only one patent, out of a hundred or more, held by the New York Filter Co., and we understand that further litigation is in progress to establish infringement of at least one other patent held by this company. As five water purification interests have already been consolidated into one, it would not be at all surprising if further consolidations should follow until there would be not more than two or three strong filter companies in the field, at the most. Even with litigation wiped out or greatly reduced, mechanical filters will find an increasingly strong competitor in sand filtration, the great merits of which are becoming more apparent every day.

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That the electric railway has come to stay, and will be still further perfected, developed and extended, no one doubts. But it is also already evident that unless states and municipalities carefully guard their rights at this early stage of development there will be trouble ahead, and this trouble will be recognized in many places when it is too late to apply efficient remedies. The owners of street railway lines now very generally recognize the economy of electric over older methods of traction; and in and about cities lines are being rapidly extended that are based upon special charters, or ordinances, that give all to the operating companies and provide a minimum for the public, either in safety in travel or in compensation for privileges granted. Electric transit, especially in suburban districts, is very pop-

ular just now, and the people are only beginning to see something beyond an immediate increase in the convenience of travel from point to point. From many places come daily reports of trolly accidents, due to high speed and careless management. Within the limits of the city of Philadelphia, an average speed of 13 miles per hour has been timed on well-used streets, and similar reports come from Newark and other cities. In Philadelphia the colossal corporation, controlling all the street railways of that city, seems to be able to obtain any legislation wanted from the municipal authorities, and the city is now gridironed with trolley lines, and power has lately been granted to occupy, with little or no compensation, many more miles of streets, some not yet opened, and to run their lines through the public parks.

At present only a few states have general laws regulating the organization, construction or operation of electric railways; and each new company, by special legislation, obtains all the privileges it can get for the least return promised, and sometimes obtains more power than the grantors contemplated. The Railway Commissioners of New Hampshire think the time is now at hand to frame a general law in that state, regulating, as much as possible, these new lines, and to bring them all under some uniform practice as to speed, safeguards to the public and as to compensation to be paid for valuable privileges granted. The framing of a law that would cover all the points in the case would be difficult; especially when it comes to guarding the people of a great city against corporate control of the people's representatives. But it is evident that our state Legislatures must seriously consider this question if they wish to guard the interests of the people. For electric lines connecting distant points, state law would alone apply, and does so now apply in the form of special legislation. But the best available remedy within great cities seems to be municipal ownership of the whole street railway system, and its lease to operating corporations on terms just to both parties, but leaving the absolute control in the hands of the city authorities. This is the plan now on trial in Toronto and in Detroit; and it has been long enough on trial in the first named city to prove the wisdom of those who carried the plan through against powerful and interested opposition. There are objections to the plan, we will admit; but these are far outweighed by the objectionable features of the present general abuse of power obtained for nothing by the street railway companies which have grown to such colossal proportions during the past few years. Electricity will not, at least for some time, supplant steam in the general transport of passengers and goods; but it is unsafe to put dimensions to its development in this direction, and it is only wise for our states and our cities to keep a watchful eye upon, and a controlling hand in, this development, by well conceived and rigidly enforced laws.

The necessity for ample protection at the dead ends or terminals of elevated railway tracks has been emphasized within the last week by an accident in Brooklyn, N. Y., which is recorded elsewhere. In this case a train running onto a middle track to be switched back onto the other track for a return trip ran into the bumper at the end of the switching track with such force as to carry away the bumper, the engine and one car falling into the street, and another car hanging partly over the street. The train was empty, but the engineman and fireman were injured, the latter fatally. According to accounts, the engineman claimed that the track was so slippery that the brakes would not hold the train, while the manager claims that other trains had used the track and that the engineman, probably, through momentary absence of mind, forgot to apply his brakes at the proper time. The manager also claimed that the company could have done nothing to make the end of this pocket more safe, a statement which, while natural enough to make to the representatives of the daily press, will hardly be considered as convincing by railway men. In many cases the bumpers in such situations do not appear to be very substantial, but in view of the possibility of accidents of this character (which might have terrible results if occurring at passenger terminals, such, for instance, as at the lofty terminal of the Brooklyn Elevated Ry. on Sands St.), it would seem to be a matter of first consideration to provide ample protection. The expense would be comparatively little, especially when the limited number of such points to be protected and the degree of safety obtained are taken into consideration.

Just what change should be made to provide the greatest safety at such terminals is a matter for consideration; but one of the most obvious things to be done would be the provision of some one of the several forms of automatic brake-applying devices which are now on the market. This would prevent such an accident as that on the Brooklyn Elevated; but, in addition, better means should be provided for bringing the train to a stop in case defective brakes or a slippery rail should cause a train to come into a terminal at too high speed. In doing this, however, it must be remembered that a train of cars in motion cannot be brought to an abrupt stop. Some way must be provided by which the energy of the moving train will be absorbed without too severe a shock, else an enormous longitudinal strain is thrown upon the elevated structure itself, which may topple it to the ground. Doubtless, the best plan of all is to make the track entering the terminal on an ascending grade, which rapidly grows steeper at the end. This of itself takes up the energy of the train and assists in a prompt start in the reverse direction.

In the design of the bumper itself the difficulty is that small space is usually available for its operation. The bumpers in common use on the elevated railways are, in general, similar to those used on steam roads, consisting essentially of two vertical posts carrying a horizontal striking or bumping timber, the posts being braced by timbers at the back and tied in front by rods to the structure, but the additional danger lying beyond the bumper, due to the elevation of the track above the ground, has apparently been lost sight of by those who are responsible for the design of the bumpers. Some of the yielding portable bumpers, which skid the front wheels and then slide along the rail, have given good results under test. Whatever is used, the principle of its design should be the gradual absorption of the energy of the train, and all the space that can be spared should be given up to it. Finally, back of these devices, whatever they may be, should be a solid timber bulwark, secured to the elevated structure itself with fastenings designed to take the shock of a collision. The track should curve sharply upward to it and the front face might well be at an angle of, perhaps, 45°. The officers of elevated railways should be deeply thankful that the accident which has called their attention to the dangers of these dead end terminals resulted in the loss of but a single life; and they should lose no time in providing proper protection for all such points, the cost of which, it may be noted, would be only a few hundred dollars at most.

The elimination of grade crossings, which is coming to be generally recognized as a work in which steady progress ought to be made, is receiving no small impetus through the rapid extension of electric railways, and the introduction of new dangers thereby. Ample evidence of these dangers has been furnished by numerous serious accidents and still more numerous narrow escapes. One of the latest accidents of this kind occurred at Paterson, N. J., Jan. 10, when an electric car ran away, on the Market St. grade, and on reaching the crossing of the New York, Lake Erie & Western R. R., broke through the gates and dashed into the rear car of a passenger train. That the danger is greater with electric railways than with horse railways is due to several reasons: 1, the greater weight and inertia of the cars; 2, the possibility of failure of the power at a critical time by a fuse blowing out, or the trolley coming off the wire while the car is jolting over the crossing; 3, the possibility of failure of the mechanism for applying the brakes or cutting off the power; and 4, the high speeds at which electric cars are often run, especially on suburban and country lines. The need of efficient protection for grade crossings of steam and electric railways, equal to that which is now provided in the best practice at grade crossings of steam railway lines, is coming to be more generally appreciated and recognized, while at the same time it has been amply proved that flagmen and the ordinary crossing gates do not afford sufficient protection.

Rules requiring motormen to stop their cars and wait until the conductor has gone over the crossing and signalled that it is safe are too often habitually disobeyed, or obeyed in a perfunctory way, which is almost as bad in results as actual disobedience. On some roads derailing switches have been put in, which are normally set to derail, and can only be closed by means of a lever on the far side of the crossing, the conductor walking over the crossing and throwing this lever before the car can enter on the crossing. Even with this precaution, however, there is the liability, especially in bad weather, of the conductor seeing one train cross and not seeing another, on account of the steam and smoke, and also of his failing to observe a train backing down on the crossing. It would be possible to electrically interlock the switch, so that it could not be thrown as long as a train was within a certain distance of the crossing, but this could not be applied to side-tracks, where cars may have to stand for a length of time. An elaboration of this system, which has already been applied in service, and was described and illustrated in our issue of Feb. 22, 1894, is to provide a complete interlocking plant of signals and derailing switches, on both the steam and electric line, but this is troublesome and inconvenient, especially where there is frequent service of trains and cars at high speed. Such equipment also involves considerable expense in first cost, in wages and in maintenance, and in cases where such complete protective plant seems to be necessary, it will often be found cheaper in the long run to provide for a permanent separation of grades.

In connection with the decoration or public recognition of engineers who have carried out important works, referred to in our last issue, it is interesting to note the recent knighting of a railway manager and a railway contractor in England. The former is Mr. Charles Scotter, who has had extensive railway experience and for the past six years has been General Manager of the London & Southwestern Ry. The contractor is Mr. John Jackson, and the reason assigned, in this case, is "recognition of the great engineering enterprises in which he has borne so conspicuous a part." Mr. Jackson built a part of the Manchester Ship Canal, and the foundations and piers of the Tower Bridge, and is now carrying out the large harbor works at Dover. These gentlemen are the latest additions to a number of eminent men in the engineering profession and railway service in England and in her colonies, who have thus been accorded public recognition of their work.

The author of the article upon "Current Meter Ratings," in our last issue, wishes to substitute for the expression: "Such reduction tables are usually furnished by the manufacturer," the following:

> Current meters should be, in construction, so near alike that a rating of one of them will be correct for all of that kind within one or two per cent.; and reduction tables, prepared from a rating of one or more of these meters, should be furnished by the manufacturers.

## CHEAPER RAILWAYS IN ENGLAND.

The construction of "light railways" in England is being seriously considered, and regular meetings of the English Board of Trade are now discussing methods and means towards this end, and a conference on this subject is advocated. As nearly as can be made out at this early stage of the proposed innovation, by "light railways" the projectors mean lines of standard or somewhat narrower gage, costing from $30,000 to $40,000 per mile, and built with heavier gradients and sharper curves than are permitted under existing English railway laws, and especially without the expensive legislative preliminaries and the rigid requirements as to stations, equipment, signals, etc., which are practically prohibitive of economical construction and operation of railways under the existing system. The demand for these roads comes from the less populous districts, and the point is made that, while most of the great trunk lines of England have been in existence for about 50 years, and in this interval the total mileage has increased 40%, little has been

done for the conveyance of produce and passengers in many sections of the kingdom lying at some distance from these main lines. It is stated that this neglect is not because the Board of Trade has been indifferent to this demand, but rather because the Board was restricted by statutes and usage, and the consent of Parliament is now required to permit any departure from the rules guiding it in sanctioning the construction of new railways. Among the inciting causes for the present discussion is the claim made by some that the excessive cost of transporting agricultural produce in England is an important element in the competition of Danish and French produce, and in the agricultural depression now so prevalent in England. This is one of the points to be especially studied and reported upon by the conference proposed by the Board of Trade. On the industrial side, the conference is to consider the best means available for enabling the workmen in crowded towns to cheaply and quickly reach the more healthy suburbs, as a place of residence.

In Belgium, within the last eight years, about 730 miles of metre-gage railways have been built, at an average cost of $13,500 per mile and under a government guarantee of one-fourth of the 3½% provided for interest and sinking fund, the other three-quarters being paid by the localities benefited. But these railways are laid upon or alongside existing highways, and in England and Scotland the highways are supposed to be too crooked and too steep, as a rule, to permit occupation by railways, and the Board of Trade, in any event, would not sanction such construction, on account of the danger to the travelling public. On the other hand, under the Irish "Light Railway Act," of 1889, some 300 miles of railways have been built in Ireland, at a cost of from $25,000 to $37,500 per mile. Of these lines 200 miles are on a 3-ft. gage and the remainder have the Irish 5 ft. 3 ins. gage. These lines connect small towns or small ports with the main railway system of the country and were built under a government guarantee of 2% on the capital cost. As a rule they have paid somewhat more than their working expenses, but, as a matter of fact, many of these lines have been built by existing main line companies on their standard system and are operated under present rigid Board of Trade requirements.

According to the official English Railway Returns, to Dec. 31, 1893, the railways of the United Kingdom aggregated 20,376 miles of track and the authorized railway capital was $1,090,898,780. This is an average cost of about $267,000 per mile of track, including in this all the constructing belonging to the railways, and this cost may be taken as some measure of the restrictions put upon railway construction in England, by existing Parliamentary statutes. The concessions made in Ireland prove that railways can be built there for the more reasonable sum of something under $40,000 per mile;, and, as the lines now demanded in England seem to be wanted chiefly as similar feeders to trunk lines, and are to be located in the more remote and less populous districts, there seems to be no good reason why a policy similar to that pursued in Ireland would not answer a like purpose. But one thing is evident, and that is that for such secondary lines Parliament must radically modify its regulations for railway construction. And this should be done for tramways, as well as railways; for one of the cheapest and best methods of solving the second part of the problem proposed by the Board of Trade, that of quickly and cheaply transporting workmen from crowded centers to suburban districts, is by the development of electric tram service. As compared with the operation of street roads by steam locomotives, it is now well established that electric power distributed from a central plant will show an economy of one-third and upward in operating expenses. Electric lines using overhead wires are comparatively cheap to construct and in the United States they have already done very much to relieve crowded centers of population, and they are rapidly extending the radius of daily travel for the workman. In fact, similar electric lines are already being used in sections of this country for the transport of light freight and produce, and as the contemplated English movement of goods does not seem to be a heavy one, nor for long distances, the English Board of Trade might find some profit in extending their investigation along the lines of electric transit.

As far as curvature and gradients are concerned, the electric roads already in use in the United States run almost anywhere; on the surface as they find it, practically, with a minimum of construction cost. But our English friends will make a serious mistake in adopting on any light lines they build anything but the English standard gage. With their light four-wheeled goods cars, some attention would have to be paid to curvature, perhaps, but almost any gradient could be used, and it is only a question of motor-power or a sub-division of traffic to take any amount of produce likely to come from the regions to be benefited out to the main lines. Economy in operation is what they are after, as much as economy in construction, and the avoidance of transhipment of load, from secondary to main lines, is an important element in this economy. If it is found expedient to operate any of these lines by steam, the gage should still be maintained at a standard, and could be so maintained at a reasonable cost for construction on lines of this description. From a business point of view, the cost of any railway should be proportional to the traffic it is to accommodate. Only the maximum traffic between crowded centers would warrant the expenditure of the money England has put into her railways, and this enormous cost which Englishmen look upon as a necessity, fully explains why the feeding lines have been neglected.

In the United States standard gage lines have been and are now being built for a much less sum than the Belgian highway lines have cost, say, from $5,000 to $10,000 per mile. And they answer their purpose satisfactorily until they develop the traffic to such an extent that their promoters can afford to spend more money upon them in lowering grades and flattening curves, or, in fact, building new lines better adapted to the increased trade. The office of American railways has been, it is true, to develop traffic, or in many places to create it; while English railways were originally built to connect centers already old and populous, teeming with business ready at hand for the railway. But, according to the talk before the English Board of Trade, these trunk lines have long been finished and the Englishman at last realizes that there are parts of his own country and certain industries that would be benefited by a little of this developing process. While recognizing the difference in prevailing conditions, there seems to be no good reason why the same principles of cheap railway construction that have supplied the United States with the finest systems of railways in the world, could not be applied to the remoter and isolated sections of the United Kingdom with profit to all concerned. The chief barrier in the way is English conservatism and the fixed conviction that the standard of railway construction adopted on the London & Northwestern Ry. is the only standard for all England,no matter how short the line or light the traffic may be. Let them modify their statutes, and especially their rigid Board of Trade rules relating to signals, stations, operation, etc., that have served their day, and learn a few lessons from other countries which have been compelled by controlling conditions to cut away from tradition, and their "light railway" problem will be easier of solution than it seems to be now.

## LETTERS TO THE EDITOR.

### THE ASSOCIATION OF ENGINEERING SOCIETIES.

Sir: I am pleased to inform you that the Association of Engineers of Virginia, and the Denver Society of Civil Engineers have become members of the Association of Engineering Societies. Yours truly,

John C. Trautwine, Jr., Secretary.

Philadelphia, Jan. 12, 1895.

(This makes ten engineering societies in the Association, the list being (in geographical order): Boston, Virginia, Cleveland, Chicago, St. Paul, Minneapolis, St. Louis, Kansas City, Denver, and Montana.—Ed.)

### HORSEPOWER REQUIRED TO PROPEL STREET CARS.

Sir: In Mr. Waterman Stone's neat little formula for horsepower necessary to draw cars, given in your issue of Jan. 10, there appears to be an error in the one for grade, which should be

$$HP. = W\ S\ \frac{(3 + 2 \times \%)}{37.5},$$

instead of $W\ \frac{3 . S + (2 \times \%)}{37.5}$, as given.

Moreover, admitting a train resistance of 30 lbs. to the ton, the two formulas can be more conveniently written thus:

On a level, $HP. = 0.08\ W \times S.$

On a grade, $HP. = 0.08\ W . S\ (1 + 0.7 \times \%).$

For a train resistance x, other than 30, multiply the level formula by $\frac{x}{30}$, which will also answer roughly for the grade formula, giving, however, results too large for values greater than 30, and too small for those less. The correct result would be closely given by:

$$HP. = 0.0027\ (K + 20 \times \%),$$

in which K = resistance in pounds per ton.

Yonkers, N. Y., Jan. 12, 1895. G.

### NATURAL CEMENT FOR MAKING CONCRETE.

Sir: Your correspondent, Mr. Henry Fulton, finds occasion to complain of my statement made in a communication to you recently, "that the use of a bond stronger than the material to be bonded would seem to answer the question of the necessity of using Portland cement in the asking of it."

Mr. Fulton claims that the reverse is true and that it is better to use a cement stronger than the material bonded. He proceeds to illustrate his point by the supposition that if he were to build a wall of indestructible or infinitely strong cement into which some stone were imbedded he would have a better wall than if a cement not so strong were used; i. e., no stronger than the stone itself. This would be practically an ideal "all-cement" wall. But let us deal with every-day facts and consider an ordinary wall, where five-sixths of the material is brick or stone, and where the cement used holds all this mass in position and exacts rigidity of the wall even at the price of the rupture of the stone or brick that in reality make up the structure. Surely, the value of a chain is equal to the strength of its weakest link, and if fractures occur in the stone along the line of the joints or elsewhere, why insist on still stronger joints? Mr. Fulton's ideal wall that depends finally upon its joints to sustain a load will find few indorsers in practice, most people preferring to depend upon the stone or brick in the wall rather than the cement in the joints, however strong the latter may be.

In the next example given, a cube is spoken of, consisting of stone or brick which, crushing at a given point, is (or one exactly similar) surrounded with a jacket of cement or other material stronger than the cube, and a much better test results. This, of course, could hardly be otherwise, but little or no credit is due to the cube. The other material, be it cement or what not, takes the load, and when it gives way, and not till then, the cube comes in, presumably, for its share of the general ruin. But to get down to practice once more, a mass of broken stone is dumped upon the ground, one-tenth its bulk in cement and sand is worked through it, with the result that each stone becoming coated with mortar is attached to its neighbor in such a way that after the cement has set, shifting and sliding when pressure comes are impossible. This pressure may be in the form of a steady force or the mass may be attacked with a sledge hammer. If, as has often been proven by actual experience, the only effect is to grind or fracture the stone, but never to disturb the cement joint, or, in other words, to make any impression on the cement mortar, it must be treated with drill and dynamite, as was recently the case in the anchorages of the Brooklyn Bridge, why should it be necessary to make a stronger joint by using a stronger cement? Here again the whole value of the concrete is only equal to the strength of its weakest element, and if that be the stone, and concrete stone has by long usage been considered abundantly strong enough, why add to the expense by demanding a joint of greater strength made of a costly cement? There is no doubt that a good result can be secured with the use of Portland cement, perhaps in some instances better than with natural cement, supposing less sand is used with the latter; but why pay a premium for strength on all kinds of work, where the strength is not required and which practically lies buried in the ground and is never used?

Yours, etc., C. M. Harris.

New York, Jan. 8, 1895.

(We believe this discussion started with the statement that there was no gain in using, in the manufacture of concrete a cement stronger than the broken stone used in it. But if we may justly compare cement and stone by their respective crushing strengths, it would appear that in the great ma-

jority of cases the stone used in the concrete is stronger than even the best cement is ever claimed to be. As a practical matter, then, the strength of the concrete will usually depend on the strength of the cement used; and in cases where strength is not important, the engineer can economize either by diluting his Portland cement with sand and lime, or by using a cheaper cement, as he deems best.—Ed.)

## AN EASY TEST FOR PAVING ASPHALTS WANTED.

Sir: I herewith enclose for publication a copy of a circular letter which I have mailed to the proper authorities in several cities and have asked their assistance as practical men who have expressed decided views as to the relative merits of asphalts.

I am trying to find out a simple and correct method whereby a man, not a chemist, can test asphalts and be able to determine whether they are or are not suited for paving purposes, and whether one asphalt will make a better wearing surface than another.

As a man of ordinary ability can in a short time learn how to test other cements it seems to me that there must be some easy method of making accurate tests of asphalt, or pitch. If there is not, and the asphalt paving business continues to be shrouded in the mystery of chemistry, how are we who are intrusted with the duty of letting contracts for asphalt paving and supervising the laying of the wearing surface, to intelligently perform our duty, unless we can determine at the works and on the street whether the asphalt composition is properly prepared, after first satisfying ourselves that the crude and refined asphalt possesses the necessary qualities.

I trust that I have been able to explain my dilemma, and that some of your readers will take an interest in the matter and write me their views and experiences.

Very truly yours, Arthur C. Harris,
President Board of Public Works.

Denver, Colo., Jan. 5, 1895.

(Circular Letter.)

Gentlemen: In Denver we are giving a good deal of attention to the asphalt question and are seeking information as to the relative merits of the various asphalts that are being used for street paving purposes.

We have in use so-called "land" and "lake" asphalts as well as the California product. If your city officials have investigated as to the relative merits of the various asphalts and have any published data pertaining thereto, we will feel under obligations for a copy. We desire to know specially what practical tests have been made to determine the value of the various asphalts now offered in competition for the paving of your streets.

(1) As your city officials who superintend street paving have expressed decided views as to the relative merits of asphalts, we presume that they have used such methods as would guide a man of ordinary intelligence and judgment in determining whether an asphalt is, or is not, adapted for street paving purposes, and whether one asphalt possesses qualities which would entitle it to be selected in preference to another, with a certainty or strong presumption that it will make a better pavement and wear longer if handled with equal skill.

(2) Have you adopted any manner or form of test that a person, not a professional chemist, can use to determine when an asphalt is submitted, and decide with certainty whether it is adapted for use in street paving or not? If you have please state the appliances and material other than asphalt used in the test, also process, conditions by and under which it is made, the results which should be produced to prove its fitness for street paving, and the results produced, or not produced, that would prove it not being adapted for street paving; also such other information or detail or direction to guide a person in making the test with unerring results, as you consider necessary.

(3) We as a board having the superintendency of the laying of asphalt pavements, experience great difficulty in finding men sufficiently conversant with the manipulation of asphalt who are able to determine whether or not the crude or refined asphalt offered by contractors possesses the necessary qualities to fit it for use for street paving, hence the necessity for the above queries.

(4) Is it, in your opinion, a fact that skill in manipulation is as important a factor in producing good results in asphalt paving as the quality of the asphalt itself?

(5) If a city is offered an untried asphalt, which possesses all the chemical and physical tests that experts deem necessary, at a lower price than is asked for the tried asphalt, is it advisable that that city accept the offer, if the bidder satisfies the proper officers that he possesses the necessary skill and is prepared to give sufficient bonds, with a guarantee to keep the street in repair for five or ten years and resurface if necessary?

There are millions in the asphalt paving question to is then followed in constructing the side wall and sewer the taxpayers if competition can be encouraged, hence the necessity for calm, unbiased research by those officials whose duty it is to look after the interests of the people.

The writer of this has patiently and persistently studied this great question for nearly two years, but as the major portion of what is written on the subject seems to be in the interest of some one variety of asphalt and condemns unqualifiedly all others, so that one who seeks light on the subject, if guided solely by these conflicting opinions, is left in a maze of doubt and distrust and knows not what path to take to lead him to the goal of absolute certainty, consequently this letter is written with the view of gleaning from "practical" men, "practical" information.

Thanking you in advance for courtesies to be received, I am, very truly yours, Arthur C. Harris,
President Board of Public Works.

## PROPOSED CEDAR RIVER POWER AND ELECTRICAL TRANSMISSION PLANT, WASHINGTON.

Sir: There is perhaps no place in the United States where so large an amount of water-power is available for development at so low a cost as in the Puget Sound country. A number of Seattle business men have started to develop an electric transmission plant to utilize the power of Cedar River, and dispense with about 13 steam-power plants which are now operating street railways, lighting plants and manufacturing enterprises in that city, and have incorporated as the Seattle Power Co. The engineering features of the water-power part of the enterprise present no serious difficulties, as nature has done a great deal in solving the problem.

Cedar River has its source in Cedar Lake, which is 29 miles east from Seattle in a direct line, and 1,625 ft. above tidewater. It contains an area at low water of 1,221 acres. It is proposed to build a dam across the outlet so as to raise the water 20 ft., which will give a storage capacity of 1,330,000,000 cu. ft. of water.

Within a distance of 2½ miles from Cedar Lake the river falls over 800 ft., the drop all occurring in the last 1½ miles. The minimum estimated flow of Cedar River, which occurs during the summer, has been placed at 10,677 cu. ft. per min. The flow is not less than 25,000 cu. ft. per min. during ten months in the year. With the above storage capacity, the daily minimum flow throughout the year can be estimated at 25,000 cu. ft. per min., which is sufficient with the above head to develop 54,590 HP. at the wheel shafts for twelve hours per day.

For the present purpose it is proposed to use Cedar Lake as a storage reservoir and to leave Cedar Falls to be used when further demands may be greater than the immediate development can supply. For the present demands of Seattle and vicinity the water may be taken from Cedar River at a point, below Cedar Falls, which is about 530 ft. above tidewater,, by building a diversion dam across the river, 150 ft. long and 8 ft. high, and thence conducted through 41,000 ft. of 48-in. wood stave pipe laid on the grade line of 1.7 ft. in 1,000, buried beneath the ground, to Swan Lake. The flume pipe will be made of Puget Sound fir staves, banded by round steel bands with upset ends.

Swan Lake will be used as a reservoir so as to economize in the consumption of water and for storage in case of any repairs being needed in flume pipe and dam connecting with Cedar River. It contains 600 acres area and is 468 ft. above tidewater. It is proposed to raise the level of this lake to 480 ft. by a dam at its outlet.

From Swan Lake the water will be conducted through an open cut for a distance of 3,500 ft., the maximum depth of cut being 24 ft. At the end of this cut the water will enter two 46-in. wood stave pipes which will be laid on a grade line of 1½ ft. in 1,000, for a distance of 7,500 ft., buried beneath the surface of the ground. These flume pipes will connect with an overflow which will take care of the surplus water from the lake and maintain a maximum head at the lake of 480 ft. From the overflow to the power house the water will be carried for 200 ft. in two 46-in. wood stave pipes, maintaining a maximum head of 150 ft. and for 600 ft. through two 46-in. steel riveted pipes, maintaining a head of 380 ft.; the power house being 100 ft. above tidewater.

Of the 380 ft., static head, 13 ft. will be lost in friction in the pipes, when running their full capacity, and 12 ft. will be used for storage purposes, leaving 355 ft. effective head when the water is at its lowest level, and 367 ft. when the water is at the upper level in the lake.

It is estimated that with the former head, 4,380 HP. can be developed, and, with the latter head, 4,518 HP. The generators will be in units of 1,000 HP. The armature shafts will be each directly coupled to three Pelton wheels running on the same shaft; three wheels being used so that one or two wheels can be always running at their full capacity and give a better efficiency in consumption of water.

The most serious objection to using water-power to operate electrical machinery has been the difficulty in properly controlling the speed, with radical changes of load, which are particularly severe in street railway service. The old style of centrifugal governors are entirely inadequate to control very great or radical changes of load. The principal cause is that a decrease in the speed of the wheels makes a corresponding reduction in the speed of the power operating the governing apparatus, and that a sudden great reduction in speed will stall the wheel before the governor can open the gates. It is important, therefore, that the power driving the governing apparatus should be entirely independent of the main power plant. For this reason the differential governor, driven by an independent source of power of sufficient magnitude to handle the gates with ease, has a decided advantage over the old styles of governors; and those that have been properly installed and adjusted show very satisfactory results. The company proposes to use the differential style of governor, one side being driven by a water wheel operated from an entirely independent source of power, the other side being driven direct from the armature shaft of the generators. A flywheel will connect with the water wheel operating the governors, to reduce the variation of speed to a minimum. As there will be from 8 to 13 separate power plants of different kinds connected with the main line, and as the quantity of water in comparison to the amount of power developed is small, it is believed that a very close regulation of speed can be obtained with the above apparatus, with variations not over 3%.

The company have made a series of tests of the seven principal steam power plants in the city to determine the average load line of each power plant, and the load line of all the plants combined and operated from a central station. They have thus been able to determine, with a considerable degree of accuracy, the greatest change of load, and the present cost of operating each steam plant.

These investigations have shown that the present average cost of 13 separate power plants in the city is 1.2 cts. per IP.H., or about $188,000 per year. The company proposes to sell this power at ¾ of a ct. per HP. hour, haking an average saving of about 35%. At this rate the plant would not only pay its operating expenses and interest on the cost of construction, but also liberal dividends on the capital stock.

T. A. Noble, Engineer Seattle Power Co.
Seattle, Wash., Jan. 4, 1895.

## THE RENO RAPID TRANSIT SYSTEM.

Sir: Pursuant to instructions from the New York Rapid Transit Commmission, their Chief Engineer, Mr. Parsons, has submitted the following, quoting from his report in your issue of Dec. 27:

The objections to a double-deck plan, especially if a clear height in each tunnel of 13 ft. were required, are:

1. A much deeper excavation, keeping the street open for much longer periods and involving the underpinning of foundations.
2. The upper tracks would not be on a solid foundation, and would therefore increase the vibration and noise.
3. The distance from the street level to the platforms of the lower tracks would necessitate elevators.

As the consideration of these suggestions is of great importance in deciding on a plan for the underground road, I beg leave to submit the following: In regard to Mr. Parsons' suggestion of the necessity of a clear height of 13 ft. for each trackway, I would refer to the details of a car designed by me to run in a space of 11 ft. square, and with ample clearance. It is only necessary to state here that the cubical contents of this car are nearly the same as on the Manhattan Elevated; the ventilators should be equally efficient; the clear headroom for passengers will be greater than on the elevated since the electric lights project only 7 ins. below the roof, while in the latter cars the lamps project over 20 inches; and lastly, as the center of gravity of this car is 14 ins. lower than the Manhattan, there will be much less oscillation at high speed. The economy of space in the tunnel (about 9% of the total cross-section) attained by the use of this car will save millions of dollars in the total cost of the 16 miles of four-track system proposed, and in addition will require passengers to descend to a less depth in order to reach the station platforms.

Regarding the construction of the tunnel, I would answer the objections made by Mr. Parsons by a general description of the method I have proposed for building it. This is illustrated by the accompanying drawing and was described in detail in Engineering News, Feb. 27, 1892, though many improvements have been added since then. The method consists in first sinking a narrow trench on only one side of the street at a time; and then filling this trench with concrete to the required height of the wall, thus constructing a wall of pure concrete. The small sewer shown in the drawing will then be built adjacent to the tunnel wall and the street surface restored. The same procedure

upon the other side of the street. The core of ground between the side walls will then be removed and the tunnel roof constructed without disturbance to the cable road and other structures above it by means of a "roof shield" which rests and slides upon the completed walls, as shown in the drawings referred to.

It must be remembered that contemporaneously with the construction of the side walls, the two small sewers have been laid and connections made, so that the old central sewer which they replace may be easily cut out below the cutting edge of the "roof shield" at the tunnel heading. The building of the tunnel walls in narrow, easily-braced trenches, as above described, followed by the construction of the tunnel proper by the "roof shield," can be guaranteed not to require the underpinning of foundations, and, as will be seen, street traffic need not be as much interfered with as under the plan proposed by Mr. Parsons.

The flat roof shown in the design of this tunnel is important, because it enables us to keep within a reasonable distance of the surface (about 8 ft.) and yet leave ample space between the roof and the cable structure for crossing pipes, subways, etc. A roof construction consisting of special steel beams with concrete filling, covered and protected by a thick layer of asphalt, before being placed in position, and subsequently further protected by a 2-in. layer of cement grouting, all of which is shown in the drawings, it is believed, will be thoroughly protected from corrosion. The roof of the tunnel at all points, even at Canal St., will be above tidewater, and those portions of the tunnel structure, such as the walls and floor, which will be exposed to water, are of concrete masonry, as shown.

In erecting the central columns, a foundation of concrete will be laid in the bottom of a small drift driven ahead at the necessary level and following the completion of the side walls. The heading of this advance drift will be kept about five weeks in advance of the tunneling operations with the "roof shield," in order to give the concrete ample time to harden before the columns are placed upon it. Having constructed the roof of the tunnel and erected the central columns upon their foundations, the invert of the tunnel will be completed by filling in the entire floor as above. At the stations I substitute iron columns for the concrete wall so that at these points there will be little more disturbance of the street surface than elsewhere.

As to Mr. Parsons' second objection; the vibration and hence the noise of the upper track can be prevented by several methods now used in railroad practice. At small additional cost the ties of these tracks can be set in asphalt in transverse trough girders, a method now popular with bridge engineers, which method would give a solid floor to the upper structure, and at the same time present a pleasing appearance for the ceiling of the lower trackways.

Mr. Parsons' third objection as to the depth to the platforms of the lower tracks, does not seem to be well taken, since the depth in the writer's plan is only 30 ft., while in the three-tunnel plan suggested by Mr. Parsons, the lower platforms are shown to be over 40 ft. in depth. Even the local tracks in Mr. Parsons' plan, on account of the arched roof, would be several feet deeper than in the writer's plan.

The position of the express tracks in this double-deck tunnel, only 12 ft. below the local, would not be a public hardship, especially with the addition of the inclined plane elevators suggested by the writer at the comparatively few express stations.

Mr. Parsons gives estimates which show that the plan he proposes, including the changes in the sewers and the building of the stations below 14th St., will cost $4,000,000 per mile. Deducting the cost of the stations as laid down by the Commission, which ought not to exceed $671,000, and also the cost of 3,274 ft. (62% of one mile (see Mr. Parsons' recent survey)) of small double sewers at 170 per foot, or $229,000, a total of $900,000, and we have roughly $4,000,000 as the cost of his tunnel proper per mile.

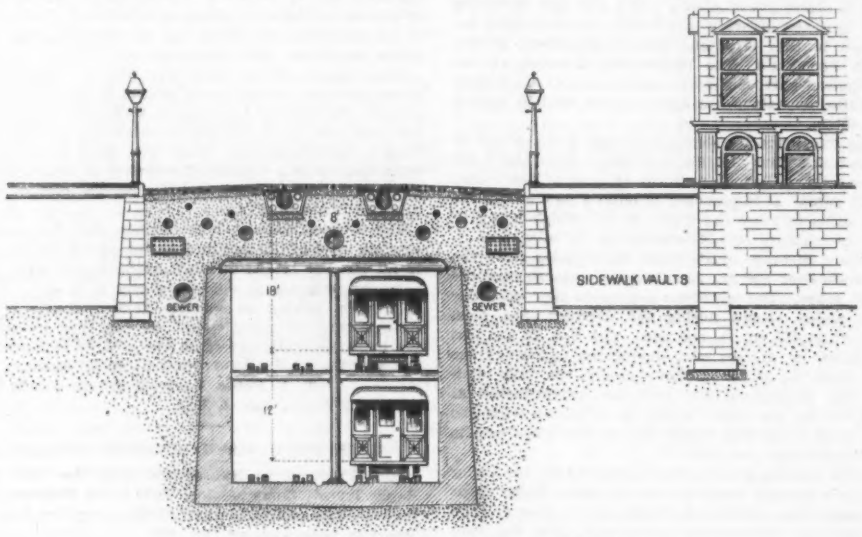
| | |
|---|---|
| In the writer's tunnel as shown, if we allow $20 per cu. yd. as the cost of the 29,216 cu. yds. of concrete composing the walls and floor | $584,000 |
| $5 per cu. yd. for excavation, by method proposed, of prism of sand, 31 ft. × 27 ft.; 163,000 cu. yds. per mile | 815,000 |
| Internal steel structure, $70 per ton, consisting of central columns, longitudinal girders and solid floor system for upper tracks | 174,000 |
| Steel at $70 per ton in roof beams and roof complete | 216,000 |
| Four tracks complete | 58,000 |
| | $1,847,000 |
| Contingencies, 20% | 369,000 |
| Total | $2,216,000 |

This shows a saving of $1,784,000 per mile for this section.

Without estimating here on the details of structure above Union Square, I beg to state, and am prepared to prove, that under my plan a proportional saving of cost along the whole line may be attained which will well permit of the construction of a rapid transit system along the route laid out by the Commission within the legal limit of $50,000,000; and I am also prepared to show that upon no other plan as yet proposed can such a four-track system be constructed without exceeding this figure. The substance of this letter has been officially submitted to the Board of Expert Engineers now dealing with the rapid transit problem.

Yours truly, J. W. Reno.

Mills Building, N. Y., Jan. 9, 1895.




THE RENO RAPID TRANSIT SYSTEM.

## A FINAL DECISION ON A MECHANICAL FILTRATION PATENT.

After seven years of litigation the legal status of patents covering the use of alum or similar coagulants in the filtration of water has been determined beyond appeal. It is now settled that the application of such coagulants to water, which after such treatment is passed immediately to and through a filter bed (in other words, without intermediate settling basins), is an infringement upon patent No. 293,740, granted Feb. 19, 1884, to Isaiah Smith Hyatt. This patent was entitled, "A Method of Purifying Water," and is now owned by the New York Filter Co. The history of the case is as follows:

In April, 1887, the Newark Filter Co., which then controlled the above patent, filed a bill of complaint in the U. S. Circuit Court, District of New Jersey, against the National Water Purification Co., alleging infringement of the patent, asking for a perpetual injunction and for $50,000 damages. Shortly afterwards the Newark Filter Co. became the Hyatt Pure Water Co., and in June, 1888, it began suit in the U. S. Circuit Court for the Northern District of Illinois against another alleged infringer of the same patent, the Jewell Pure Water Co.

The second suit was dismissed at the complainant's cost, on Feb. 13, 1889. Moreover, on July 27, following, a disclaimer to the original Hyatt patent, mentioned above, was filed, striking out a part of the specifications, in which certain broad claims were made. This disclaimer is cited below. The original suit between the Hyatt and National Cos. was continued, if we are correctly informed, until their consolidation, early in 1892, as the New York Filter Co., as noted in our issue of Feb. 20, 1892. The American Filter Co., of Chicago, was also included in this consolidation, and in addition the new company now holds the patents on the filter known as the Blessing, and certain patents on the aeration of water, formerly controlled by the U. S. Pure Water Co.

On May 1, 1893, the New York Filter Co. again took up the suit on the Hyatt patent, alleging infringement in the case of a Jewell filter, in use at the Murray Hill Turkish Baths, New York city. Meanwhile, the Jewell Pure Waer Co. had become the O. H. Jewell Filter Co. On June 9, 1894, Judge Shipman, of the U. S. Circuit Court, for the Southern District of New York, rendered a decision in favor of the New York Filter Co., as stated in our issue of June 28, 1894. The case was carried to the United States Circuit Court of Appeals, a stay of injunction being granted, meanwhile, by Judge Shipman. On Nov. 1 and 2 an argument on the appeal was made before Judges Wallace, Lacombe and Coxe, and on Jan. 9, 1895, an opinion was filed by Judge C. J. Wallace affirming the decree of the Circuit Court.

Judge Wallace's opinion seems much clearer than that of the lower court. He states very plainly that, in using alum in filters without the intervention of settling basins, there is an infringement; but that with such basins there is not.

Having given the history of the case, some reference may be made to the claims of the original Hyatt patent, upon which so much litigation has been based. The claim allowed in this patent was as follows:

> The method hereinbefore described of arresting and removing the impurities from water during an uninterrupted passage of same from a supply-pipe into a filtering apparatus, thence through a filter-bed contained therein, and out through a delivery-pipe leading therefrom, which method consists in introducing into the water simultaneously with its passage to or into the filter a substance which will sufficiently coagulate or separate the impurities to facilitate their arrest and removal by the filter-bed, thus obviating the necessity of employing settling basins.

As will be seen, the above claim specifies no chemical to be used as a coagulant. The specifications, however, refer several times to persulphate or perchloride of iron, or "other coagulating agent," or words similar to the three quoted, and in a paragraph stricken out in a subsequent disclaimer, already mentioned, permanganate of potassa was named. This disclaimer was as follows:

> I do not confine myself to the employment of persulphate or perchloride of iron or permanganate of potassa, but make use of any other suitable agent which is capable of coagulating the impurities of the liquid, and preventing their passage through the filter-bed. Neither do I limit myself to any particular proportions or quantities of the coagulating agent, as they may be varied according to circumstances and the character of the liquid to be treated. Nor do I confine myself to any particular liquids, although I contemplate chiefly the purification of water in large quantities.

In this suit the defendants had urged that the Hyatt patent was null through lack of originality and that, whether null or not, the disclaimer limited the patent to the two salts of iron named. After reviewing the case and referring to some references to earlier patents, Judge Wallace says, in answer to the first point:

> The patent in suit describes a departure from anything which appears to have been done or known in the prior art, so far as appears by the record.

The departure consists in the discovery, in the language of the Judge, "that the agglomerating action of the coagulants could be obtained without waiting a considerable time for precipitation, or during the passage of the water through the filtering-bed."

Judge Wallace's conclusions, in regard to the dis

claimer and his summary of the case, are as follows:

The patent after the disclaimer is to be read exactly as though the recital had never been inserted. Thus read, it is clear that the claim covers the use of any coagulant having similar properties to the salts of iron, which was a recognized equivalent.

As thus construed, the infringement of the claim by the defendants is established, although they use alum as the coagulant instead of the salts of iron. In some of the plants of the corporation defendant settling tanks are used between the introduction of the coagulant and the filter-bed. In these plants the method of the patent is not appropriated, and there is no infringement.

The decree of the Circuit Court is affirmed with costs.

Of course, this decision applies to all companies or persons making or using mechanical filters in which alum or a similar coagulant is used. Wherever the water receives the coagulant as it passes into the filter, the Hyatt patent is infringed, but if settling tanks are employed, in Judge Wallace's words, "there is no infringement."

## THE HEAT VALUE OF WESTERN COALS.

Next to wages the cost of fuel is the largest item in the cost of locomotive engine service, yet very few railways make much endeavor to determine the comparative steam-making values of the different coals available for their use, or to learn whether or not they are being used under the best conditions to develop fully their heating value. A paper read at the December meeting of the Western Railway Club, by Mr. Wm. Forsyth, M. Am. Soc. M. E., Mechanical Engineer of the Chicago, Burlington & Quincy R. R., discussed this question at some length, especially with regard to Western coals. We abstract some of the more interesting features of this paper in this article.

Statistics from the accounts of the Chicago, Burlington & Quincy R. R. show that the largest item in the operating expense account is engine service, being 22% of the total expense for the year 1893. The largest item in the cost of engine service is wages, and next to that is fuel. The relative proportion of the principal items in cost of engine service, as an average for 10 years—1883 to 1893—is:

| | Per cent. |
|---|---|
| Fuel | 30.7 |
| Wages | 39.0 |
| Repairs | 27.6 |
| Miscellaneous | 2.7 |
| Total | 100.0 |

The total amount of fued used on the C., B. & Q. R. R. in the year 1893 was 925,270 tons, costing $1,291,108. An idea of this vast amount of coal may be realized when it is stated that it is twice the whole amount of coal consumed in the city of Chicago in the year 1893 by all her industries and in all her heating and power boilers. The consumption of coal by locomotives in the United States in the year 1893 amounted to 50,000,000 tons, or about one-third of the whole production of bituminous and anthracite coal in this country.

Coal presents the remarkable example of a great staple whose market value is arbitrary. Iron ore and other mineral ores are sold at prices varying with the varying amount of metal they contain, but coal does not take its standing in the market from the character of its constituent elements. The principal reason why this is so is the difficulty of getting an average sample of coal, and because laboratory methods are not generally used to determine its value. The value of coal is not wholly dependent upon its percentage of combustible matter, but varies with the relative percentages of water, sulphur and ash. It is also necessary to confine comparisons to coals containing nearly the same relative percentage of volatile matter and fixed carbon.

The methods in use for determining the heat value of coal are: (1) Chemical test, (2) calorimeter test, (3) test on small boiler, and (4) test on a large scale on a locomotive. We quote from the paper as follows:

It is first necessary to obtain a fairly representative sample. A valuable paper on the sampling of bituminous coal seams, by Dr. J. P. Kimball, will be found in the transactions of the "American Institute of Mining Engineers," vol. XII., p. 317. He says:

The unsuitable sampling of a coal seam, or the improper preparation of the sample in the laboratory, often gives rise to errors in determinations of the ash so wide in range as to vitiate the analysis for all practical purposes; every other single determination, excepting moisture, showing its relative part of the error. The determination of sulphur and ash are especially liable to error, as they are intimately associated in the slates.

This trouble in getting a fairly average sample of anthracite coal has compelled the Reading R. R. Co., in getting their samples, to take as much as 300 lbs. for one sample, drawn direct from the chutes, as it stands ready for shipment.

The directions for collecting samples of coal for analysis at the C., B. & Q. laboratory are as follows:

Two samples should be taken, one marked "average," the other "select." Each sample should contain about 10 lbs., made up of lumps about the size of an orange taken from different parts of the dump or car, and so selected that they shall represent as nearly as possible, first, the average lot; second, the best coal. Samples should be marked: Name of mine; name of operator, town, county and state.

Hardness.—With every handling of soft coal there is a greater or less loss through crushing and attrition. The greater the hardness the less the waste in moving from the mine, and in transportation. At some mines the waste in slack and fine coal, or dust, is from 4% to 15% of the total amount taken out. Some Iowa coals are so soft that they will endure very little handling, and the output of such mines must be almost entirely local.

Chemical Analysis.—The proximate analysis is generally used in coal determinations. The determinations commonly made are: (1) Moisture; (2) Volatile combustible; (3) Fixed carbon; (4) Ash; (5) Sulphur.

Method of Analysis.—The moisture is determined by heating a known weight of coal for one hour at a constant temperature of 105° C., or slightly above the boiling point of water. From the loss in weight the percentage of moisture may be calculated. For the other components, excepting sulphur, a second weighed portion of coal is heated in a covered crucible, to a dull red heat for 3½ minutes; the temperature is then raised to a bright red heat for an equal length of time. After subtracting the amount of water previously determined, the loss in weight represents the volatile combustible matter. Longer subjection to heat would be at the expense of the fixed carbon. The coke which remains in the crucible after the volatile matter has been driven off, is again subjected to a red heat (with cover of crucible removed), until the remaining carbon is consumed. This is taken as the amount of fixed carbon. The weight of the residue gives the percentage of ash. It is essential that similar conditions be maintained for each sample in a series of coal analyses. The determination of sulphur is made independently, no attempt being made to distribute it among the elements in the previous analyses. The sulphur which is already oxidized in the coal, and which is separated as sulphate, will however be found in the ash.

Moisture.—Moisture in coal is doubly deleterious, causing a negative loss by adding to the weight without increasing the heating value, and a positive one, by requiring evaporation, thus diminishing the available power of the fuel. The amount of moisture in Iowa and Illinois coals of fairly good quality varies from 2% to 12%, the average being about 7%.

Volatile Combustion.—The volatile combustible matter comprises in a general way the gaseous constituents of coal. The moderate heat employed in its determination is sufficient to expel the greater part of the various compounds of carbon and hydrogen. When their combustion is complete these gases have high calorific power, but owing to the devices in common use, the volatile portions of bituminous coal are almost entirely wasted, passing off in light clouds of pure carbon, accompanied by the lighter gases of combustion and distillation. In this manner a large portion of the inherent virtue of the coal is worse than wasted. The difficulty of effecting a complete combustion of the volatile portion of coal is the cause of the smoke nuisance. The simple requirements of high temperature and a proper supply of air are so difficult to secure that after all the agitation and study given to the subject, comparatively little progress seems to have been made.

Fixed Carbon.—In the uncombined, or fixed carbon, lies the greatest value of coal, though in uniting with oxygen only about one-third as much heat is developed as in the union of an equal amount of hydrocarbons, as its non-volatile properties insure for this portion of the coal more complete combustion. The percentage of fixed carbon is therefore the best basis for a comparison of coals for steam purposes. A sufficient quantity of volatile matter must be present to insure easy ignition and free combustion. The oxidation of the fixed carbon tends to heat the volatile gases up to a point of ignition, and then if a proper amount of oxygen is supplied, we obtain a temperature in the furnace and the tubes much higher than that obtained where fixed carbon, such as is found in anthracite coal, is burned without mixture with any large amount of hydrocarbons. In the combustion of anthracite coal, which is largely fixed carbon, an intense local heat is developed near the grate bars, but the temperature of the gases is not so intense; hence the necessity of a large grate and shallow firebox with anthracite coal, so that the radiant heat from the ignited fixed carbon can be directly absorbed by a large crown sheet.

Ash.—The residue left after combustion has no positive effect in reducing the efficiency of the fuel, but is generally an inactive constituent, from which nothing is realized, and this always at constant expense.

When the approximate value of a coal is found by its contents or combustible matter, the actual value for boiler purposes is not exactly proportioned to this percentage, for a deduction must be made for increased cost of firing and removal of ash, since with every reduction of fuel elements a corresponding increased amount of coal must be burned to make the same quantity of steam.

Sulphur.—When in a condition to be easily oxidized the injurious effects of sulphur more than offset any addition of the calorific power of coal. Its presence in large percentage is seen in the tendency of the coal to slack and disintegrate when exposed to the weather. Even under cover sulphurous coals will not stand storing for any length of time. Spontaneous combustion in the mines is often due to the presence of this element. In coal the sulphur is generally combined with iron, forming pyrites, or the sulphuret of iron. This is very susceptible to oxidation.

The analysis of coal is one of the simplest and easiest determinations made in the laboratory, and I believe if this fact were more thoroughly realized that the purchase of coal would be regulated more by coal analysis. A bright boy, with an ordinary education, could in a few days learn to make the principal determinations in a coal analysis. The volatile matter and coke can be determined in ten minutes, and the separation of coke into fixed carbon and ash requires from one to two hours, depending on the per cent. of ash, a large per cent. of ash requiring the longer time. The determination of sulphur requires about five hours, and as a regular thing the sulphur determination is not necessary. When the coal is found to be very bad in sulphur it is not desirable for fuel for any purpose, and small percentages are objectionable only as they reduce the fuel value.

During the year 1893, the C. B. & Q. laboratory, at Aurora, Ill., analyzed quite a large number of samples of coal, and the results of the principal ones are given in Table I. The Illinois coals were all collected by one of the laboratory chemists. The other coals were sent in by different parties. Of the Illinois coals those marked "average" represent the average quality of the coal in the car. Those marked "select" are the analyses of a small lump of the best-looking coal in sight. Where there is a great difference in the results between the "average" and "select" sample, the quality of the coal shipments could probably be improved by picking the coal before loading onto the cars. The pounds of water represent the amount of water one pound of coal could evaporate, if all the heat were used. The test was made in a Thompson calorimeter. In actual practice only about half this efficiency can be obtained. From this table it will be seen that the coals in each different State have a peculiarity of contents of ash and moisture, and a specification for coal from any particular coal field must have some reference to its predominating composition, but after a number of samples have been analyzed it will be easy to see how high the per cent. of fixed carbon can be placed, and how low the per cent. of ash and moisture.

After a number of analyses and calorimeter tests have been made, it is possible to predict from the fixed carbon about what the heat value should be, and calorimeter measurement would not be necessary. Again, when the volatile portion is nearly constant in hydrocarbon, the calorimeter test should be sufficient to show the probable heat value.

Where there is difficulty in getting samples to represent the average quality of coal, and a more exact heat value is required, a resort must be made to physical determinations on a larger scale, and on a test boiler. At the principal shop on any road where a small stationary boiler may be used, this boiler could be fitted up for testing purposes, and equipped with conveniences for measuring water and coal, the temperature of the gas, and the pressure of the draft. A farther refinement would consist of a permanent boiler plant with special provision for avoiding errors from loss of heat by radiation and conduction, as well as various proportions of water in the steam. Mr. Wm. Kent has proposed, as a still greater refinement, that a boiler be used for heating water, and special provision be made for careful insulation.

A coal test on a still larger scale is that made by measuring the coal and water used on a locomotive and getting a sufficient number of trips under conditions as nearly constant as possible, so as to get aver-

age results, which will be compared with other tests. In 1885 the C., B. & Q. R. R. Co. made an exhaustive series of tests of this kind for all the Illinois coals that were then used, and the results are given in Table II. The comparison of the actual heat value of the coal and the price charged for it, as shown in the last two columns, is interesting, and illustrates the importance of the purchase of coal on a basis of its real value.

TABLE II.—Locomotive Tests of Illinois Coals Made by the C. B. & Q. R. R. in 1885.

| Name of coal. | Lbs. water evap. per lb. coal. | Comp. evap. value, Streator evap. per lb. coal as unity. | Cost at mine. | Actual value. |
|---|---|---|---|---|
| Streator | 5.65 | 1.000 | $1.30 | $1.30 |
| Kewanee | 4.09 | .724 | 1.45 | 1.05 |
| Galva | 4.48 | .793 | 1.25 | .99 |
| Edwards | 4.37 | .773 | 1.15 | .89 |
| St. David's | 4.76 | .842 | 1.15 | .97 |
| Elmwood | 4.81 | .851 | 1.30 | 1.11 |
| Norris | 4.58 | .811 | 1.15 | .93 |
| Kramm's | 4.50 | .796 | 1.15 | .92 |
| Colchester | 5.63 | .996 | 1.875 | 1.87 |
| Cleveland, Ill. | 5.05 | .894 | 1.50 | 1.34 |
| Astoria | 5.15 | .912 | 1.20 | 1.09 |
| Winchester | 5.02 | .888 | 1.525 | 1.35 |
| Belleville | 5.29 | .937 | 1.25 | 1.17 |
| Mendota, Mo. | 4.65 | .823 | 1.30 | 1.07 |
| Carver | 5.03 | .890 | 1.30 | 1.16 |
| Albia | 5.20 | .920 | 1.40 | 1.29 |
| Whitebreast | 4.94 | .874 | 1.45 | 1.27 |
| Jumbo, Pa. | 7.25 | 1.283 | ... | ... |

Note.—Each coal was used on six or eight trips. Temperature of feed water, 70° to 75°; thermometer, 70° to 80°; boiler pressure, 138 lbs.; speed, 19 miles per hour; grate surface, 17.6 sq. ft.; heating surface tubes, 1,078 sq. ft.; heating surface firebox, 112 sq. ft.

Mr. Forsyth advocates a regular specification for the purchase of coal, the terms of this specification to be based upon the results obtained from a number of tests. For Illinois coals the following specification is recommended:

Two samples shall be taken, one marked "average," the other, "select." Each sample shall contain about 10 lbs., made up of lumps about the size of an orange, taken from different parts of the dump or car, and so selected that they shall represent as nearly as possible, (1) the average lot, (2) the best coal.

The hardness shall be sufficient to admit of a haulage of at least 300 miles without making more than 1% fine slack.

The fixed carbon shall be as high as possible, and the ash and moisture as low as possible.

Average samples will be taken from any shipment, and will be subject to chemical analysis. The following is the desired composition:

| | Per cent. |
|---|---|
| Maximum moisture | 5 |
| " volatile matter | 35 |
| " sulphur | 2 |
| " ash | 10 |
| Minimum fixed carbon | 48 |
| Total | 100 |

The Simplon tunnel project, under a late agreement between the Italian and Swiss governments, has assumed a practical and definite shape, and plans are prepared for its construction, and the contract is let. On the Swiss side of the Alps the line commences at the Brigue terminus of the railway leading to Boverret, on Lake Geneva, and following the valley of the Rhone. After leaving Brigue the route follows the Rhone and reaches the northern face of the tunnel 1½ miles beyond Brigue. The tunnel will be 12¼ miles long, will have a summit 2,300 ft. above sea level and the south end will be 175 ft. lower than the north, or Swiss, end. The southern half is on a grade of 0.7%. The south, or Italian, end of the tunnel is on the River Diveria, near Chioso. The chief peculiarity in this Alpine tunnel is that there will be two separate parallel single-track tunnels 56 ft. apart connected at intervals by cross galleries. Each tunnel will have a section of 250 sq. ft., and will be 14 ft. 9 ins. wide at the level of the ties, 16 ft. 5 ins. wide at a point 6½ ft. above the ties, and 18 ft. high from top of ties to the bottom of the arch-key. The contract for construction was given to Messrs. Brandt, Brandau & Co. on Sept. 20, 1893, at $1,400,000 for preliminary construction; $9,500,000 for the first single-line tunnel with parallel gallery, and $3,000,000 for completing the second tunnel. The first tunnel is to be finished in 5½ nels complete. This price does not include land purchase and permanent way, nor the ballast for the second tunnel. The first tunnel is to be finished in 5½ years from the date given for commencement of work. The second tunnel is to be finished in four years from the beginning of work upon it under an agreement made between the contractors and the company. The sum of $92 per lineal foot is allowed for the completion of the first 3,300 ft. of the tunnel, besides $23.33 per foot for the parallel gallery and drainage channel, and $18.75 per foot for the connecting galleries. These prices are to be progressively increased as the work advances towards the center of the tunnels.

TABLE I.—Table Showing Results of Calorimeter Tests of Western Coals Made by the C., B. & Q. R. R.'s Testing Laboratory at Aurora, Ill., in 1893.

| Locality and Coal Company. | Average or Selected. | Moisture. | Volatile. | Fixed carbon. | Ash. | Lbs. water.* |
|---|---|---|---|---|---|---|
| **Illinois Coals.** | | | | | | |
| Buckheart....Whitebreast Co. | Average. | 6.14 | 29.94 | 46.27 | 17.65 | 10.62 |
| " " " " | Select. | 8.92 | 33.52 | 48.06 | 9.50 | 11.66 |
| Bryant..... " " | Average. | 2.42 | 32.91 | 42.64 | 22.03 | 10.29 |
| " " " " | Select. | 3.88 | 38.05 | 48.75 | 9.32 | 12.25 |
| Canton.....A. W. Heald & Son | Average. | 3.51 | 36.90 | 46.69 | 12.81 | 11.33 |
| " " " " " | Select. | 4.40 | 38.32 | 48.09 | 9.19 | 11.94 |
| Claire.....Sunday Creek Coal Co. | Average. | 3.16 | 32.94 | 43.05 | 20.85 | 10.34 |
| " " " " " | Select. | 5.27 | 37.30 | 48.21 | 9.22 | 12.21 |
| Cuba.....Wm. Rutherford & Co. | Average. | 4.17 | 36.38 | 48.62 | 10.83 | 11.77 |
| " " " " " | Select. | 6.50 | 35.85 | 49.91 | 7.65 | 11.99 |
| Dunfermline..Whitebreast Fuel Co. | Average. | 2.46 | 32.91 | 45.57 | 19.06 | 10.84 |
| " " " " | Select. | 3.54 | 37.50 | 52.37 | 6.50 | 12.49 |
| Edwards.....C. B. Kramm & Co. | Average. | 1.90 | 34.48 | 43.62 | 20.00 | 10.29 |
| " " " " " | Select. | 5.04 | 33.96 | 49.56 | 11.44 | 11.44 |
| " .....Howarth & Taylor Bros. | Average. | 3.20 | 35.48 | 47.77 | 13.55 | 11.33 |
| " " " " " | Select. | 4.08 | 38.24 | 52.17 | 5.51 | 12.75 |
| Elmwood.....Elmwood Coal Co. | Average. | 1.36 | 27.69 | 35.41 | 35.54 | 9.13 |
| " " " " | Select. | 1.90 | 34.70 | 48.23 | 15.17 | 11.44 |
| Farmington..U. S. Pierce & Co. | Average. | 3.41 | 33.88 | 45.89 | 16.82 | 10.84 |
| " " " " " | Select. | 6.17 | 35.96 | 48.49 | 9.38 | 11.94 |
| Ladd.....Whitebreast Fuel Co. | Average. | 8.49 | 33.63 | 44.12 | 13.76 | 11.17 |
| " " " " | Select. | .... | ..... | ..... | ..... | 11.72 |
| Norris.....D. H. Williams | Average. | 7.10 | 32.12 | 49.74 | 11.04 | 11.06 |
| " " " " | Select. | 7.49 | 35.19 | 54.45 | 2.87 | 12.82 |
| Peoria.....Consolidated Coal Co. | Average. | 3.22 | 36.13 | 49.21 | 11.44 | 11.77 |
| " " " " | Select. | 3.18 | 39.24 | 50.56 | 7.02 | 12.21 |
| Pottstown....I. Wantling & Son | Average. | 4.58 | 35.52 | 45.52 | 14.38 | 11.17 |
| " " " " | Select. | 5.51 | 35.92 | 49.76 | 8.81 | 12.05 |
| St. David.....Carbon Coal Co. | Average. | 2.00 | 34.60 | 46.20 | 17.20 | 11.11 |
| " " " " | Select. | 3.07 | 35.88 | 52.95 | 8.46 | 12.27 |
| " .....Whitebreast Fuel Co. | Average. | 1.50 | 33.77 | 47.67 | 17.06 | 11.44 |
| " " " " | Select. | 1.38 | 37.42 | 55.89 | 5.31 | 12.82 |
| Streator.....Star Coal Co. | Average. | 4.45 | 39.19 | 44.05 | 12.31 | 11.80 |
| " " " " | Select. | 2.16 | 40.20 | 54.97 | 2.67 | 13.61 |
| " .....C. W. & V. Coal Co. | Average. | 8.30 | 37.63 | 45.93 | 8.14 | 11.88 |
| " .....Coal Run Coal Co. | Average. | 8.40 | 38.25 | 47.10 | 6.25 | 12.14 |
| Vicary.....C. B. Kramer & Co. | Average. | 5.78 | 36.60 | 47.14 | 10.48 | 11.94 |
| " " " " " | Select. | 7.40 | 36.26 | 51.61 | 4.73 | 12.65 |
| **Iowa Coals.** | | | | | | |
| Hiteman.....Whitebreast Fuel Co. | ..... | 4.99 | 35.27 | 25.37 | 34.37 | 9.27 |
| Keb..... " " " | ..... | 9.81 | 37.49 | 44.75 | 7.95 | 11.88 |
| Flaglers..... " " " | ..... | 9.29 | 38.86 | 39.97 | 11.88 | 11.06 |
| " " " " | ..... | 9.84 | 40.16 | 37.60 | 12.31 | 11.22 |
| Chisholm..... " " " | ..... | 9.18 | 40.42 | 39.58 | 10.82 | 11.77 |
| **Missouri Coals.** | | | | | | |
| Brookfield....Brookfield Mining Co. | ..... | 4.34 | 40.27 | 50.60 | 4.79 | ..... |
| Mendota.....Mendota Coal & Mining Co. | ..... | 9.03 | 37.48 | 46.24 | 7.25 | 11.85 |
| Hamilton.....Hamilton Coal Co. | ..... | 5.27 | 38.09 | 51.88 | 4.76 | 13.09 |
| " .....Caldwell Coal Co. | ..... | 5.06 | 34.24 | 47.69 | 13.01 | 11.55 |
| Lingo.....Little Pittsburg Coal Co. | ..... | 7.33 | 38.20 | 47.24 | 7.14 | 12.43 |
| **Nebraska Coals.** | | | | | | |
| Hastings.....Colorado Fuel Co. | ..... | 0.21 | 27.82 | 60.88 | 11.09 | 13.39 |
| **Wyoming Coals.** | | | | | | |
| Cambria | ..... | 4.2 | 40.6 | 41.5 | 13.7 | ..... |
| " | ..... | 4.0 | 36.0 | 37.7 | 22.3 | ..... |
| " | ..... | 2.5 | 37.4 | 37.9 | 22.2 | ..... |
| Goose Creek | ..... | 9.7 | 40.2 | 46.3 | 3.8 | ..... |
| " " | ..... | 13.3 | 39.3 | 44.2 | 3.2 | ..... |
| Deek Creek | ..... | 12.8 | 35.0 | 47.7 | 3.6 | ..... |
| Sheridan | ..... | 6.04 | 42.37 | 35.57 | 16.02 | ..... |
| Goose Creek | ..... | 12.43 | 40.25 | 43.68 | 3.64 | ..... |
| " " | ..... | 13.92 | 36.78 | 42.03 | 7.27 | ..... |
| Felix | ..... | 16.24 | 35.39 | 40.55 | 7.82 | 9.41 |
| " | ..... | 15.17 | 38.14 | 40.91 | 5.78 | 9.41 |
| Awada | ..... | 14.32 | 34.45 | 48.15 | 3.08 | 10.40 |
| **Miscellaneous Coals.** | | | | | | |
| Edwards.....C. B. Kramm & Bro. | ..... | 6.64 | 34.71 | 40.74 | 17.91 | 10.84 |
| " " " " " | ..... | 5.98 | 30.43 | 34.89 | 28.70 | 9.41 |
| " " " " " | ..... | 9.34 | 28.95 | 35.03 | 26.68 | 9.35 |
| " .....Howarth & Taylor Bros. | ..... | 5.85 | 35.64 | 42.47 | 16.04 | 11.11 |
| " " " " " | ..... | 6.29 | 32.71 | 41.35 | 19.65 | 10.73 |
| " " " " " | ..... | 9.54 | 32.18 | 35.31 | 22.97 | 9.96 |

* This column represents the amount of water that 1 lb. of the coal would evaporate from and at 212° if all the heat in the coal were utilized.

The office of the Supervising Architect of the Treasury Department is being reorganized under orders from Secretary Carlisle. Under the new regulations there is to be a supervising architect, who shall have absolute control and direction of the six following divisions of work: (1) Engineering and Drafting Division, for preparing all designs for buildings which are not open to public competitions under present or future legislation, also for all repairs; (2) Tracing Division; (3) Photograph Division; (4) Computing Division, which shall prepare estimates of cost and specifications (5) Repairs Division; (6) Inspection and Material Division. All business of an executive or administrative nature not coming under the jurisdiction, as above, of the supervising architect will be conducted by a chief executive officer, whose duties are described as follows: This chief is to receive all visitors on public business except material men and those with business of an architectural or technical nature; he will receive and distribute to the proper divisions all mail matter; check all letters and papers originating in these divisions as to proper official form; he is charged with maintaining discipline in the several divisions of the office and under him are to be two other divisions of law and records, charged with putting on permanent record all deeds and other papers relating to titles for sites for public buildings, etc., and keeping the accounts of the bureau. A board of awards is created for the awarding of contracts, and is made up of the Supervising Architect, the Chief Executive Officer and the Assistant Secretary of the Treasury in charge. A majority of this board must concur before sending any recommendation to the Secretary of the Treasury, though a majority and minority report may be sent in. These regulations took effect on Jan. 1.

Municipal ownership of street railways is making progress in London, England, and the London County Council is now advertising for proposals for a lease of certain lines, about 4¼ miles long, from Holloway Road to the St. Pancras railway station, which are about to be taken over by the Council under the provision of the Tramway Acts and an award made by Sir Frederick Bramwell, M. Inst. C. E. The lease will be for a term, commencing from the date when the Council takes over possession from the company so far as insure continuity in the service of the lines, terminating Dec. 31, 1900, with power for the Council to determine it at any time on or after Dec. 31, 1898, by three calendar months' notice. The lessee will have to take over and pay for certain stock, consisting of 68 cars and 649 horses and harness and stable utensils, which the Council, under the award and agreement aforesaid, has to take over from the company, at the price at which the same are to be so taken over by the Council by valuation.

The phosphate deposits of Tennessee have been reported upon by Dr. C. W. Hayes, of the Geological Survey. From the rock phosphate deposits in Hickman County, opened over one year ago, between 30,000 and 40,000 tons of high-grade rock have been shipped. White phosphate has been found in Perry County very similar to some of the Florida deposits, but at present it does not seem of much commercial importance.

A conference on light railways for increasing transportation facilities in the country districts of England was recently held by representatives of the Board of Trade, several chambers of commerce and other public bodies. One gentleman thought electric traction

could be adopted to advantage in many cases, especially where water power is available for use in generating the current. Mr. Bryce, of the Board of Trade, referred to the claim for increased suburban traffic facilities by means of such railways, built either along the roads or upon acquired land, but pointed out that the Board could not relax its requirements as to signals, fencing, stations, etc., unless a law was enacted to permit such action. As these requirements are almost prohibitory to economical light railways, the sooner such legislation is adopted the better.

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Caissons, or floating dock-gates, says A. W. Ackerman in a paper recently read before the Civil and Mechanical Engineers' Society, of England, were apparently first used in 1728 at the port of Rochefort, in France. There is some evidence, however, that they were invented much earlier by the dock-builders of the Venetian Republic. Wooden caissons were introduced into England by Gen. Bentham, at Portsmouth, and iron caissons were first used in the Woolwich docks. No great improvement in their design took place until 1865, when Sir Andrew Clarke, Director of Works for the Admiralty, introduced the modern form or caisson-gate into the docks at Chatham and Portsmouth.

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Belgian rails to the amount of 4,300 tons, have been bought by the Dominion government for use on the Intercolonial, Prince Edward Island, Windsor and other government railways. The contract was made with the John Cockerill Co., of Belbium, for delivery at Halifax before June, 1895. The price paid is said to have been about $20 per ton.

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Electric headlights are being tried on the cars of the Coney Island & Brooklyn Ry., Brooklyn, N. Y. They are made by E. Tilman, of New York.

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Director Walcott, of the U. S. Geological Survey, has recommended to Congress an addition of $5,000 to the appropriation bills to pay for the proposed distribution of ten topographical atlas sheets of maps of the United States to each of the colleges, academies and schools above the grade of the common school in this country. The number required is estimated at 14,000,

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The extended use of electric traction on street railways, combined with the enormous growth in favor of the bicycle,is said to have affected the price of horses to the extent of from 25 to 50% as compared with two years ago, according to a special investigation made by the "American Agriculturist."

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The American Bell Telephone Co., whose Berliner patent has been declared invalid by the late decision of Judge Carpenter, of the U. S. Circuit Court, says it can get along without the Berliner inventions. It claims that without the Edison patents, which it controls, the Berliner patents are commercially worthless. These four Edison patents cover the microphone, or transmitter of a telephone, now substituted for the tube-like instrument which the Bell people formerly used for transmitting and receiving, the patent on which expired in 1893.

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Gasoline motors are to be tried on a local railway, between Crisfield, Md., and Tangier Sound, according to newspaper reports.

## ANNUAL MEETING OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The annual meeting of the Society was held in New York city, Jan. 16 and 17. At the business meeting on Jan. 16 the President, Col. W. P. Craighill, in the chair, the first business was the consideration of the report of the Committee on Amendments to the Constitution, appointed by the president in pursuance of certain resolutions passed at the business meeting of the annual convention of 1894. The most important of the amendments was that providing that ballots for reconsideration of an application for membership shall be signed by the members, thus doing away with the secret ballot on reconsideration, which secret ballot is said in the committee's report to have been abused in not a few cases, to the detriment and discredit of the Society. The only other important amendment was in regard to the nominating committee, the method of appointment of which has always been awkward and unsatisfactory. Under the new plan, there are to be seven geographical districts, the first comprising the territory within 50 miles of New York, and the others contain, as nearly as practicable, an equal number of members. The divisions are to be announced by the Board of Directors on or before May 1 of each year. At the business meetings of the annual convention, seven corporate members (not officers of the Society), one from each of the geographical districts, will be appointed by the meeting (the method of appointment being purposely left to the choice of the meeting) to serve for two years, and these members, with the five living last Past Presidents, are to constitute the nominating committee, so that each year the committee will consist of five new members, five members of the committee of the previous year, and five Past Presidents. Both of these amendments were adopted.

Another amendment, submitted separately, makes the appointment of an assistant secretary by the Board of Directors, discretionary instead of mandatory.

The report of the Special Committee on Uniform Standard Time was then read; the report being adopted and the committee continued.

The next report was that of the Special Committee on Uniform Methods of Testing Materials used in Metallic Structures, and on Requirements for these Materials to Further Improve the Grade of Such Structures. The majority report recommended certain tests, while the minority report of Mr. Perceval Roberts held that it was not advisable to recommend to the society any definite set of specifications. There was considerable discussion as to what should be done with the report, some members considering that it should not go out so as to be considered as having been adopted by the society, while others thought that committee reports should not be held back in any way. A representative of the Pennsylvania Steel Co. stated that the adoption of a set of specifications of tests by the society would be most welcome, such specifications to be not necessarily uniformly used but to serve as a basis and for reference, but he did not consider the tests recommended in the report as what manufacturers would consider right and proper. The report was eventually received, and later, on motion of Prof. Merriman, a resolution was adopted to the effect that it was the sense of the meeting that full opportunity should be given for discussion of the report, and that a date should be set for such discussion.

The report of the sub-committee on methods of tests of the Committee on International Standards for the Analysis of Iron and Steel was then presented by Mr. Metcalf, who stated that this was only a partial report, as the work now in hand cannot be completed for two or three years. The report deals with the analysis of standard steels, and describes the methods followed by the different experimenters. The report was accepted and the committee continued.

The report of the Committee on Uniformity of Measurements was then called for, and a member of the committee made a verbal and informal report of progress. The committee was continued.

The announcement was made that the Rowland Prize had been awarded to Paper No. 617, on "Distinctive Features and Advantages of American Locomotive Practice," by Mr. D. L. Barnes. The Norman Medal was awarded to Paper No. 641, "A Proposed Method of Testing Structural Steel," by Mr. A. E. Hunt.

The election of officers for the year 1895 resulted as follows, there being 709 votes counted: President, George S. Morison, of Chicago, Ill. (390 votes out of 691, while Mr. Wallace received 244 votes); Vice-Presidents, Desmond FitzGerald, of Brookline, Mass. (676), and Benjamin M. Harrod, of New Orleans, La. (658); Treasurer, John Thomson, of New York city (699); Directors, George H. Benzenberg, of Milwaukee, Wis.; George H. Browne, of Pittsburg, Pa.; Robert Cartwright, of Rochester, N. Y.; Fayette S. Curtis, of New Haven, Conn.; Augustus Mordecai, of New York city, and Charles Sooysmith, of New York city. Under the amended constitution the Secretary is not an elected officer but will be appointed by the Board of Directors.

In the evening there was a reception at the Waldorf Hotel. On Jan. 17 there was an excursion by steamer to the government station at Willets Point, where the torpedo works and the immense magnet were examined, and in the evening Mr. Charles E. Emery delivered an illustrated lecture on "The Utilization of the Forces of Nature."

## BOOK REVIEWS.

MICRO-ORGANISMS IN WATER: Their Significance, Identification and Removal, together with an Account of the Bacteriological Methods Employed in the Investigation. Specially Designed for the Use of Those Connected with the Sanitary Aspects of Water Supply. By Percy Frankland, Ph. D., B. Sc. (Lond.), F. R. S., Associate of the Royal School of Mines, etc., and Professor of Chemistry in University College, Dundee, St. Andrews University; and Mrs. Percy Frankland, Joint Author of "Some New and Typical Organisms Obtained from Water and Soil," "The Nitrifying Organism and its Specific Ferment," etc. London and New York: Longmans, Green & Co. 8vo; pp xi., 532; three colored plates and 28 illustrations in the text; $5.

The title of this book and the names of its authors will at once attract the large and rapidly-growing body of persons interested in the question of securing pure water. No members of that body are more interested in the subject than those engineers who are being called upon from day to day to devise plans for improving old and securing new water supplies. To such it is of the utmost importance to know what enemies to health, if any, are lurking in a present or prospective water supply, and how they may be removed, when no better supply is practicable. This volume presents in compact and lucid form the most recent information regarding water bacteriology, much of it being the results of special researches by the authors, and nearly all of it not heretofore readily available, except to the few.

The first three chapters of the book relate to bacteriological technique, and will be of use to those who wish to make investigations on their own account.

The fourth chapter is on the "Bacterial Contents of Various Waters," and, with the sixth, "On the Multiplication of Micro-Organisms," contains much statistical and other matter necessary or useful for a correct understanding of the subject.

The fifth chapter is the longest, and, perhaps, the most important, one in the book. It is on "The Purification of Water for Drinking Purposes." The principal method of purification discussed is slow sand filtration. In addition to this, various other methods which have been tried are considered in more or less detail. The use of alum is touched upon briefly, but no account is given of the results obtained from the mechanical filters so extensively used in this country, where alum treatment is followed by rapid sand filtration. Two foreign processes are briefly described, in which a precipitant is used with mechanical aids to sedimentation. The good results secured with the small Pasteur-Chamberland and Berkefeld filters are included.

The investigations made by Prof. Frankland, in 1886, 1887 and 1888, on the purification of the London water supply, effected by sand filtration, are presented in this chapter. Sedimentation is an important factor in the purification of water, and was also studied in connection with the London supply. The authors quote a passage written by Prof. Frankland in 1886,* which they believe subsequent investigations have fully verified, as follows:

> The factors which, in my opinion, are more especially calculated to influence the number of micro-organisms present in the distributed water are the following: (1) Storage capacity for unfiltered water; (2) Thickness of fine sand through which filtration is carried on; (3) Rate of filtration; (4) Renewal of filter beds.

The value of these opinions and the accompanying discussion is greatly increased by the fact that they are based upon a study of the water furnished to London by seven companies, most of the water being taken originally from the Thames or the Lea, but receiving very different subsequent treatment from the different companies as regards storage and character of sand filtration.

The chapters not already mentioned have the following titles: "The Detection of Pathogenic Bacteria in Water;" "The Vitality of Particular Pathogenic Bacteria in Different Waters;" and "The Action of Light on Micro-Organisms in Water and Culture Media." The conclusion of the last chapter, so far as it relates to water, is that while sunlight is a powerful germicide, and one which should be made the most of in water-works construction, yet there has been a tendency to exaggerate it. The great difficulty in climates like England is that "a great deal of the surface-water is never exposed to adequate insolation at all, even in the case of shallow streams in which, under more favorable climatic conditions, this bactericidal agency might be highly effective."

The final 120 pages, excepting the index, of the volume are taken up with concise descriptions "of the principal characters of all the micro-organisms, numbering upwards of 200, which, as far as the authors have been able to ascertain, have been found in water." These descriptions are in much smaller type, for economy of space, than the body of the book, and have side heads for ease in reference. The 20 bacilli found in water, and known to be pathogenic to man or animals, have the titles of their descriptions printed in red.

The typography, press-work and binding of the book are excellent, and it will be found a valuable acquisition to the library of any engineer or sanitarian.

A DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES. By Edwin J. Houston, A. M., Ph. D. 3d Edition. New York: The W. J. Johnston Co., Ltd. Cloth; 8vo; pp. 607; 582 illustrations; $5.00.

The rapid advancement in electrical science which is going on is well illustrated by this book. The first edition was issued in 1889. In 1892 a second edition

*Water Purification; its Biological and Chemical Basis. Trans. Inst. C. E., LXXXV., pp. 197-263, including discussion.

was issued nearly twice the size of the first, and in 1894 a third edition became necessary. The new matter in the third edition adds about 20% to its bulk and is not incorporated with the older part of the work, but is printed as an appendix. While this makes the book less convenient for reference, it of course greatly lessened the cost of issuing the new edition. In justice to the purchasers of the second edition, however, the publishers should allow them to purchase this appendix separately when desired, and thus bring their old books up to date. While Professor Houston's work is properly called a dictionary, it can by its fulness of descriptions and illustrations lay some claim to the title of encyclopedia. Naturallyt this much increases the usefulness of the book, for it is far more often consulted by those in search of information than by those desiring to find an exact definition for some electrical term. In the author's desire to include all electrical terms in his work, he has in some cases rather overstepped the mark and has inserted matter which might better have been omitted, and the space given to fuller explanations of strictly electrical terms. Thus we find such terms as "polishing mop" and "building iron" from the electrotyper's workshop; also "stoneware dipping bowl," "electrically illumined buoy," "burglar alarm contacts, trap and matting." A still worse blemish arises from the excessive use of cross-references. Thus we find under "Proposed," over a column devoted to "Proposed A. I. E. E. Definitions" for a dozen different electrical terms, and the definition is not given at all in this place, but the reader is referred to the term itself. A single cross-reference would have been far better than this column of references. There are also not a few terms used which are pretty certain to drop out of use as electrical science becomes further developed and on a more settled and permanent basis. The direction for the improvement of the dictionary, therefore, seems to be by condensation rather than amplification, and by giving more space to important terms and less to cross-references and terms not strictly electrical.

PHYSICAL UNITS. By Thomas Gray, Professor of Dynamic Engineering, Rose Polytechnic Institute. Bulletin No. 1, 1894-95, of the Rose Polytechnic Institute, Terre Haute, Ind. Pamphlet; 8vo; 30 pp.

Prof. Gray here gives the dimensional and conversion factor formulas for the more commonly occurring derived units. These include units of area, volume, density, velocity, angle, curvature, tortuosity, momentum, force, elasticity, work and energy, resilience, etc.; and to illustrate each formula, he works out an example. Heat units, electric and magnetic units, and electrostatic and electro-magnetic units, are separately and more elaborately discussed. The pamphlet closes with a list of the names and values of ordinary units, as defined at the International Congress at Chicago in 1893.

PRACTICE AND THEORY OF THE INJECTOR.—By Strickland L. Kneass, C. E., M. Am. Soc. M. E., Member Franklin Institute and Member of the Engineers' Club of Philadelphia. New York: John Wiley & Sons. 8vo; cloth; pp. 132, with many diagrams; $1.50.

The book before us is a most interesting treatise upon a subject which needs both practical experience and the ability to theorize correctly to discuss it properly. The first two chapters describe, in an entertaining style, the invention of the injector by Henri Jacques Gifford, in 1858, and the principal developments in the instrument in the way of making it adjustable, lifting or non-lifting, automatically restarting, etc. The following chapters describe the construction of the injector and the design of each of its separate parts. Chapter VII. discusses the action of the injector, and Chapter VIII. describes foreign and American practice in the application of injectors, with description of the various patterns on the market. In this chapter there is a very small amount of matter concerning the ejector, or steam jet pump, and also some description of exhaust steam injectors. These subjects might well have been treated more fully, in view of their importance, and the little that is known concerning them by engineers generally. The author's discussion of the efficiency of the injector is not so clear as it should be, and will very likely be misunderstood by some readers not familiar with the subject. We look in vain for any statement of the efficiency of injectors, considered merely as machines for forcing water against a certain pressure. It is true that for use as boiler feeders this is of minor importance, but where the ejector, or steam jet pump, is concerned this is of great importance. On p. 87 the author makes a typical comparison of the direct-acting steam pump and the injector as boiler feeders, and finds that in feeding a 100-HP. stationary boiler the injector will save about 5 lbs. of coal per hour, the saving arising through the utilization of the heat which goes to waste in the exhaust of the pump. On p. 90 the author says that increasing the head under which a non-lifting injector works does not give an increased capacity. We presume he does not mean that a heavy pressure on the suction, such as that from a city water-supply, would not increase the capacity, but just what he does mean is not quite certain.

On the whole, the work is a real contribution to engineering literature, and one on which its author, who bears a name honored in the annals of American engineering, is to be congratulated.

MASONRY DAMS—On the Stresses in, with oblique sections; Pamphlet, 8vo, 11 pp., 2s. On Curved Masonry Dams. Pamphlet, 8vo, 14 pp., 2s. A Practical Method of Determining the Profile of Masonry Dams. Pamphlet, 8vo, 13 pp., with diagrams, 2s. 6d. All by W. B. Coventry, M. Inst. C. E. New York: Spon & Chamberlain, Publishers.

In the first of the above separate pamphlets the author discusses the principle of oblique sections in determining the dimensions of a masonry dam, as generally practiced among French engineers, and first suggested by M. Guillemain and M. Hetier in 1885-86. Mr. Coventry regards this method as incorrect and as merely an empirical means of introducing a slightly varying increase of the factor of safety. In the second pamphlet he discusses the straight vs. curved plan of dam; and if curved, whether it is possible to determine a rational value for the radius. He distinguishes between a curved and an arched dam; he does not believe that there is such a thing as an arch dam designed to resist the thrust of water on the principle of the arch alone. He uses the arch action only as an additional factor of safety. He discusses and shows diagrams illustrating the deflection of straight and curved dams, and from the equations given he shows that the stresses due to partial arch action of a curved gravity dam vary inversely as the radius of curvature; and not directly as the radius, as in the case of complete arch action. He therefore recommends a radius that would give from the start a moderate arch action of, say, 3 tons per sq. ft., and thus to make it practically certain that the intended additional security has been provided. He says the action due to an arch of large radius would tend to crush the dam directly it failed to act as a gravity dam. In the third pamphlet Mr. Coventry endeavors to bring the process of designing a masonry dam within the range of ordinary office work, and proposes and explains by diagrams and equations, an "exceedingly simple and rapid method." This method is applicable for any values of top width of dam, weight of masonry and permissible stress met with in practice. It also provides for the vertical component of water pressure so often neglected. He does not claim that the results are mathematically correct, but believes that the errors in the deduced profile are insignificant.

IRRIGATION: Part II of the Report of the United States Geological Survey for 1890-1. J. W. Powell, Director. 4to; pp. xviii., 576; 93 plates and 190 illustrations in the text. Part II. of the same report for 1891-2. 4to; pp. xi., 486; 177 plates, 119 illustrations in the text and folding map in pocket. Pub. Docs.

All but some 200 pages of the report for 1890-91 has been previously published in separate form. The section on "Irrigation in India," by Mr. Herbert M. Wilson, M. Am. Soc. C. E., was noticed in our issue of March 30, 1893, and that on the "Hydrography of the Arid Regions," by Mr. F. H. Newell, was reviewed in our issue for June 20, 1893. The remainder of this volume consists of a "Report upon the Location and Survey of Reservoir Sites During the Fiscal Year Ended June 30, 1891," by Mr. A. H. Thompson.

A large part of the report for 1891-2, and perhaps the most valuable matter in the two reports, has also been published separately and was noted in our columns on May 31, 1894. These sections were entitled "American Irrigation Engineering," and "Engineering Results of the Irrigation Survey," and were written by Mr. H. M. Wilson, Am. Soc. C. E. This volume also contains a report by Mr. F. H. Newell, on "Water Supply for Irrigation," which deals with the characteristics of the "Missouri, Yellowstone and Platt River Basins," refers to the extent of irrigation at the time of report and gives some figures regarding precipitation and stream measurements. The detailed work on reservoir sites is also reported on in this volume and by Mr. Thompson, as in the report for the previous year.

The delay in the publication of these volumes seems inexcusable, but much of the best matter which they contain was made public some time ago. This, however, necessitated, it may be supposed, a considerable amount of extra expenditure.

Many of the line engravings in the text are poorly executed, but the plates, some of which are colored, are much better and many of the half-tone views deserve praise for their excellence.

CITY ROADS AND PAVEMENTS Suited to Oswego, N. Y. By William Pierson Judson, M. Am. Soc. C. E., M. Inst. C. E. New York: Engineering News Pub. Co. 8vo; pp. viii., 60; seven inset sheets; cloth, $1.00; stiff paper, 75 cts.

Although this volume was written primarily to further the cause of good roads and pavements in Oswego, nearly all the matter presented is equally applicable to other cities, and much of the information it contains was collected by the author for practical use because he could not find it elsewhere. The different classes of pavements are described in a clear and concise manner and details of construction and cost are given. To secure the most recent figures possible in relation to brick pavements, Mr. Judson sent circulars to the city engineers of a number of cities in which brick is in use as a paving material. To these inquiries 50 replies were received, which, with figures from articles in Engineering News and elsewhere, bringing the number of cities up to 65, are presented in tabular form in the book. This table gives for each city the miles of brick pavements in use in June, 1894, the cost per square yard of "best work" on different foundations, the kind of joint filling used and the results reported. Of the illustrations three are colored plates showing practical points of construction and four are street scenes, reproduced from photographs. The book would be useful for distribution among city officials where educative work is necessary to show how roads should and should not be con-

IMPOUNDING RESERVOIRS IN INDIA and the Design of Masonry Dams. Comprising the Following Papers: I. The Tansa Works for the Water Supply of Bombay. By William John Bird Clerke, B.A., C. I. E., M. Inst. C. E. II. The Baroda Water-Works. By Jagannath Sadasewgee, Assoc. M. Inst. C. E. III. The Water Supply of Jeypore, Rajputana. By Col. Samuel Swinton Jacob, C. I. E., Assoc. Inst. C. E. IV. On the Design of Masonry Dams. By Franz Kreuter, Professor of Civil Engineering in the Royal Technical Academy of Munich. With an Abstract of the Discussion Upon the Papers. Edited by James Forest, Assoc. Inst. C. E., Secretary. Excerpt Minutes of Proceedings of the Institution of Civil Engineers. Vol. CXV., session 1893-4, part I. London. Published by the Institution. 8vo., paper, pp. 182; illustrated.

This is really a symposium on dam construction. Of the four papers named, one describes a large masonry structure, one an earth, and the other a sand embankment, neither of the two latter having heart walls. The fourth paper is a theoretical discussion of the design of masonry dams. The discussion is by 35 engineers, 20 of these taking part by correspondence. These comprise many engineers of international reputation, and include a number of American engineers. The discussion occupies 110 of the 180 pages of the volume and brings out facts in relation to a number of dams besides those described in the papers. The first three papers contain some general descriptive matter relating to the several water-works.

STAIR-BUILDING in its various forms; and the new one-plane method of hand-railing as applied to drawing face-moulds, unfolding the center line of wreaths, thereby obtaining exact lengths of balusters, and also unfolding side moulds. Numerous designs and plans of stairs, newels and balusters for the use of architects, etc. Wood, iron and stone stairs. By James H. Monckton, author of other works on this subject, etc. Fourth edition; revised and extensively enlarged. New York: John Wiley & Sons. 4to; unpaged; many plates; $4.00.

The title of this book fully explains its scope and applications, and for the purpose intended it is doubtless a useful work. It is certainly minute in its treatment of the subject. But this usefulness and the appearance of the book would be much enhanced by a complete change in the form of its text. Its title-page is the worst piece of typesetting we have lately seen, and the explanatory text is objectionable in form. For the credit of the publishers, who usually show great good taste in such matters, we must assume that this work is issued chiefly from old stereotyped plates and the new part has been simply made to conform with the old.

THE STRESS AND STRAIN OF ELASTIC SOLIDS: Introduction to the Mathematical Theory of, by Benjamin Williamson, D. Sc., D. C. L., F. R. S.; Fellow and Senior Tutor of Trinity College, Dublin. London and New York: Longmans, Green & Co. 12mo; cloth; pp. 132; $1.50.

This is purely a mathematical treatise. The author says, concerning his chapter on "Elastic Beams," that it was "to a great degree written for the use of the practical student." But the "practical student" who would spend valuable time struggling through this mass of algebra, with the hope of extracting from it knowledge of practical use in this work-a-day world, would be doomed, we fear, to disappointment. We can hardly conceive a practicing engineer making use of such a book in connection with the problems that come before him; and as for the use of such works as text-books in engineering schools, we believe that the tendency is away from the old idea that an engineering student must absorb huge doses of mathematics, regardless of his natural qualifications for mathematical work.

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## PERSONALS.

Mr. Charles W. Babbitt has been elected City Surveyor of Natchez, Miss.

Mr. C. W. Bliss has been appointed Assistant General Superintendent of the Boston & Albany R. R.

Mr. W. H. Locke has been appointed Assistant Sanitary Engineer to the Health Department of Brooklyn, N. Y. The offices are at 38 Clinton St.

Mr. G. M. Eldridge, Assoc. M. Am. Soc. C. E., has been re-elected City Engineer and Superintendent of Water-Works at Americus, Ga.

Mr. Henry King has been appointed Superintendent of Terminals of the Louisville, Evansville & St. Louis Ry., at New Albany, Ind.

Mr. John Siggins, Street Commissioner, of Orange, N. J., died Jan. 11. He was born in Ireland in 1822, and came to this country in 1848.

Mr. William H. Gaylor, architect, of Brooklyn, N. Y., and formerly Building Commissioner of that city, died Jan. 8, at the age of 74.

Mr. Charles O. Russell, formerly Superintendent of the Boston & Albany R. R., died at Springfield, Mass., Jan. 8.

Mr. Francis H. Reynolds, Assoc. M. Can. Soc. C. E., died in Montreal recently. He was born in London in 1843, went to Canada in 1865, and became a patent solicitor.

Mr. J. W. Cook has been appointed General Superintendent of the Eastern Division of the Norfolk & Western R. R., vice Mr. D. W. Flickwir, resigned. His office is at Roanoke, Va.

Mr. George W. Street, Assistant Naval Constructor, U. S. N., died at San Francisco, Cal., Jan. 11. Mr. Street had just removed to San Francisco, after serving for three years at the Brooklyn Navy Yard

Mr. W. H. Fenner, who has been elected President of the National Car Wheel Co., at Buffalo, N. Y., was formerly President of the Allen Paper Car Wheel Co., and later of the Grant Locomotive Works, of Chicago.

Mr. James M. McDonald, Superintendent of the Phoenix Bridge Works, died at Phoenixville, Pa., Jan. 9, at the age of 44. He was a native of Scotland, and a man of experience in civil engineering and bridge work.

Mr. Edward Knight, of the engineering department of the Homestead Steel Works, has accepted a position with the Lloyd Booth Co., of Youngstown, O., and will be in charge of its engineering and estimating department.

Mr. Thomas Riley, formerly Assistant Superintendent of the St. Louis, Kansas City & Colorado R. R., has been appointed Division Superintendent of the Monterey & Mexican Gulf Ry., with headquarters at Monterey, Mexico.

Dr. William Osler, of Johns Hopkins University, Baltimore, Md., has been appointed president of McGill University, Montreal, Canada, vice Sir William Dawson, who resigned some time ago on account of ill health. Dr. Osler is a Canadian by birth.

Mr. H. E. Vanderlip has accepted a position in charge of the engineering and drafting department of the Brown-Ketcham Iron Works, of Indianapolis, Ind. Since last summer he has been in the employ of Post & McCord, engineers and contractors, of New York city.

Mr. E. B. Wheelock, General Agent and Land Commissioner of the Texas & Pacific Ry., at New Orleans, La., who died Jan 4, was one of the original promotors of the New Orleans & Pacific Ry., which was chartered in 1878, and afterwards became a part of the Texas & Pacific system.

Lieutenant-General Sir John Summerfield Hawkins, R. E., who died in London, Jan. 10, at the age of 79, was commissioner for marking out the boundary between the British and the United States territories west of the Rocky Mountains, from 1858 to 1863. He was retired in 1881.

Mr. H. W. Battin, Division Engineer of the Minnesota and Dakota Divisions of the Chicago & Northwestern Ry., with office at Winona, Minn., has had his duties extended to cover the Madison Division, owing to the resignation of Mr. C. C. Pudor, Division Engineer, at Madison, Wis.

Sir Hussey Vivian, or Lord Swansea, the well-known English metallurgist, died recently at the age of 73. He was the head of the great Vivian smelting and reduction works at Swansea, Wales, making a specialty of the treatment of gold, nickel, copper, and other ores, and was a recognized authority on such work.

Mr. Henry C. Frick, Chairman of the Carnegie Steel Co., has resigned from that position, and been appointed Chairman of the Board of Managers, so that he will still be at the head of affairs, but will not attend to matters of detail. Mr. John G. A. Leishman, who has been Vice-Chairman, is now Chairman of the company

Mr. J. D. Hawks, M. Am. Soc. C. E., Manager of the Detroit, Bay City & Alpena Ry., has been elected Vice-President and General Manager of that road, which has been reorganized under the name of the Detroit & Mackinaw R. R. He was formerly Chief Engineer of the Michigan Central R. R., resigning in 1892 to accept the position of General Manager of the Detroit Citizens Street Ry., which position he still retains.

Mr. Charles K. Moore, Civil Engineer and Contractor, has been appointed Deputy Commissioner of Street Cleaning for New York city, by Commissioner George E. Waring, Jr. Mr. Moore was educated at the Columbia School of Mines; was chief engineer of the Saratoga Lake Ry. and the South Atlantic & Ohio R. R, and is said to have been the originator of the present Plainfield, N. J., water supply system, obtained from suburban sources. He is a resident of New York

Mr. E. M. Herr, M. Am. Soc. M. E., who has been appointed Assistant Superintendent of Motive Power of the Chicago & Northwestern Ry., was for some years with the Chicago, Burlington & Quincy R. R., as engineer of tests, and later as superintendent of telegraphs and division superintendent. Afterwards he was Division Master Mechanic of the Chicago, Milwaukee & St. Paul Ry., and then Superintendent of the Grant Locomotive Works, at Chicago, until the works were closed.

Mr. Theodore D. Wilson, ex-chief constructor of the navy, and at present on leave of absence, is an applicant to be retired from active service under the same conditions as if he still held the position, which he relinquished by reason of ill-health. There is a bill now pending before Congress authorizing the Secretary of the Navy to grant the request of Mr. Wilson, in view of his services in designing many of the new ships now in commission. Mr. Wilson was for three terms head of the construction corps, but his health became impaired by close attention to duties, which compelled his resigning in favor of Chief Constructor Hichborn.

Mr Aaron L. Dennison, who introduced the manufacture of watches by machinery into this country, died at Birmingham, England, Jan. 9. He was born at Freeport, Me., in 1812, and began life as a journeyman watchmaker. In 1849 he convinced a friend, Mr. Edward Howard, a clock and scale maker of Boston, that the manufacture of watches in large quantities, on the interchangeable plan, would prove a profitable undertaking, and after interesting some capitalists, they established a factory at Waltham, Mass., in 1854, but this was sold in 1857, on account of financial troubles. Later he was interested with Mr. A. O. Bigelow in a factory at Melrose, Mass., but afterwards withdrew and went to England, where he settled.

Mr. William Lush, who died recently at Poughkeepsie, N. Y., was engaged for 17 years (ending August, 1886) upon the New York Central & Hudson River R. R. as Assistant Engineer, Resident Engineer and Principal Assistant Engineer. Among the many works executed by him, that of elevating the railway through the streets of Rochester, N. Y., is the most prominent. He left this road to become Chief Engineer of the St. Joseph & Grand Island R. R., which he constructed. He was Chief Engineer of the Kansas City & Omaha Ry., and was afterwards engaged on the Union Pacific R. R. under Mr. Bogue, until 1890, when his health failed him. He was about 45 years of age at the time of his death.

Col. Ulysses G. Scheller Debuol, soldier and civil engineer, died at Galena, Ill., on Jan. 12. He was born in Switzerland in 1816, and, after graduating at Heidelberg, came to the United States in 1830. He went to California, but in 1842 returned to Europe and entered the Austrian army as a civil engineer. In 1848 he was identified with the Kossuth movement, and was compelled to leave the country. He came to America again, and was one of the engineers to survey the route of the Illinois Central R. R. from Chicago to Galena. In 1861 he entered the Union army as a civil engineer, and served until the end of the war, being for a time on the staff of Gen. Grant, with the rank of Colonel. Since the war he has lived in retirement at Galena.

## ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Feb. 20. Secy., F. Van Vleck, Los Angeles, Cal.
ENGINEERS' CLUB OF PHILADELPHIA.
Jan. 19. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERS' CLUB OF MINNEAPOLIS.
Jan. 21. Secy., E. Nexsen, Kasota Block.
DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 22. Secy., F. Ed. King, 36 Jacobson Block.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Jan. 23. "History of the New York Water-Works." Secy., F. R. Hutton, 12 W. 31st St., New York city.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Jan. 23. "The Use of Steel in Large Buildings," C. T. Purdy. Secy., S. E. Tinkham, City Hall. Rooms, 36 Bromfield St.
CENTRAL RAILWAY CLUB.
Jan. 23. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.
ENGINEERS' CLUB OF INDIANAPOLIS.
Jan. 26. Secy., C. C. Brown.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 31. Secy., C. H. McLeod, 112 Mansfield St., Montreal.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Feb. 1. Secy., O. Von Geldern, 719 Market St., San Francisco.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Feb. 4. Secy., C. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
Feb. 4. Secy., Geo. R. Sikes, Buffalo, N. Y.
WESTERN SOCIETY OF ENGINEERS.
Feb. 6. Secy., C. J. Roney, Chicago.
ENGINEERS' CLUB OF ST. LOUIS.
Feb. 6. Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Feb. 6. Secy., Francis Collingwood, 127 E. 23d St., New York.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Feb.9 Secy., G. O. Foss, Helena, Mont.
WISCONSIN POLYTECHNIC SOCIETY.
Feb. 11. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
Feb. 11. Secy., F. W. Tuttle, Baird Building.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Feb. 12. Secy., F. C. Osborn, 721 Hickox Building.
NORTHWESTERN SOCIETY OF ENGINEERS.
Feb. 12. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
NORTHWESTERN RAILWAY CLUB.
Feb. 12. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NEW ENGLAND RAILROAD CLUB.
Feb. 13. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Feb. 14. Secy., G. W. Shaw, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
Feb. 14. Secy., H. D. Ruhm, Nashville, Tenn.
FRANKLIN INSTITUTE, PHILADELPHIA.
Jan. 18. "Mineral Resources of the United States," by David T. Day, Secy., W. H. Wahl, 16 South Seventh St., Philadelphia.
COLUMBIAN ENGINEERING SOCIETY.
Feb. 19. Secy., W. F. Hart, Washington, D. C.
WESTERN RAILWAY CLUB.
Feb. 19. Secy., W. D. Crosman, Club Room 9, Grand Pacific Hotel, Chicago.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Feb. 20. Secy., J. H. Pilcher, Roanoke, Va.
NEW YORK RAILROAD CLUB.
Feb. 21. Secy., John A. Hill, 256 Broadway, N. Y. City.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Feb. 21. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Feb. 21. Secy., J. F. Wilson, 24 W. 4th St.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
March 15. Secy., D. W. Meeker, St. Paul, Minn.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
April 18. Atlanta, Ga., Secy., F. A. Charpiot, Macon, Ga.

NEW ENGLAND WATER-WORKS ASSOCIATION.—At a meeting of the association, held in Boston, Jan. 9, a paper on "Water Supply Required for Steam Fire Engines" was read by Mr. Dexter Brackett, M. Am. Soc. C. E., and one entitled "Eternal Vigilance the Price of Good Water," by Mr. Geo. F. Chace. Mr. Brackett's paper was based on experiments made by him with fire engines in Boston, full details of which are given in the last report of the City Engineer of Boston. Mr. R. C. P. Coggeshall, for many years secretary of the association, tendered his resignation, and Mr. Brackett was elected as secretary pro tem.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the meeting in New York on Jan. 16 the following papers were presented: "The Units of Light and Radiation," by Prof. Alexander Macfarlane, of Ithaca, N. Y.; and "The Best Metal for Field Magnet Frames," by Mr. A. D. Adams, of Boston, Mass. A meeting of Western members was held the same evening at Chicago, at which the above papers were also presented and Prof. Stine gave an illustrated historical sketch of the first three-wire Edison plant at Sunbury, Pa. Ralph W. Pope, Secy.

ENGINEERING SOCIETY OF WESTERN NEW YORK.—This new society has been organized at Buffalo, N. Y., and will hold meetings on the first Monday of each month. The officers are as follows: President, George E. Mann; Vice-Presidents, E. B. Guthrie and Walter McCulloh; Secretary and Treasurer, George R. Sikes; Directors, George B. Burbank, C. M. Morse. The officers and directors constitute an executive committee. Those named are all civil engineers, with the exception of C. M. Morse, who is a mechanical engineer.

ENGINEERS CLUB OF PHILADELPHIA.—At the meeting of Jan. 5, Mr. Charles D. Walcott, Director of the U. S. Geological Survey, in a communication, explained the scope and method of the work of his department. He touched upon the necessity of co-operation in Federal and State surveys, and his paper was illustrated by lantern reproductions of maps, instruments and equipment. L. F. Rondinella, Secy.

STATE AND LOCAL BOARDS OF HEALTH OF OHIO.—The fifth annual meeting of these boards will be held at Columbus, Jan. 24 and 25. Mr. W. B. Gerrish, City Engineer of Oberlin, will present a paper on "Sewage Purification at Oberlin." (See Eng. News, June 14, 1894, for description of land disposal of sewage at this place.) Other subjects of more or less sanitary interest will be discussed.

AMERICAN INSTITUTE OF MINING ENGINEERS.—It is proposed to hold the 68th meeting of the Institute in Florida, the plan, as at present provisionally contemplated, being to adjourn the annual meeting of February, after the transaction of formal business, from the New York office to Jacksonville or Ocala, Fla., where sessions would be resumed on March 26. The meeting would then be continued in sessions at various points in Florida, combined with a tour of the state, comprising visits to the leading typical phosphate mines on the west side and to the famous watering-places at Tampa Bay, Punta Gorda, etc., followed by a trip including St. Augustine, the Indian River, and Lake Worth on the east side. It is expected that the visits to mines, and probably all the sessions, would be over in one week, and that the remaining tour through the beautiful scenery of the east side would occupy a second week. Very liberal arrangements are promised by the railway companies; and, although details cannot be given at this time, it is estimated that the cost of the full two weeks, reckoned from New York as a starting point, would not exceed $100 for each person, including railway and Pullman car fare and hotel bills. The adoption of the above plan, and also the possible reduction of expense below the figure above given, will depend upon the number of members and guests who will attend the meeting. R. W. Raymond, Secy.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the meeting on Jan. 8 a paper by Mr. James Ritchie on "Paving in Cleveland as Compared with Paving in other Cities" was read by the secretary.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—The twelfth annual meeting was held Jan. 7. There was a discussion on the Minnesota state survey, and the committee on this subject was given another month in which to make its report. The following officers were elected: President, N. E. Stevens; Vice-President, K. E. Hilgard; Treasurer, A. O. Powell; Librarian, A. Munster; Secretary, C. L. Annan; Representative on the Board of Managers of the Association of Engineering Societies, E. E. Woodman.

CANADIAN SOCIETY OF ENGINEERS.—At the ordinary meeting on Jan. 17 a paper on "The Great Lakes, Their Commerce and Physical Features," by Mr. H. A. Gray, was read, and a paper on "The Resistance of Piles," by Mr. H. F. Perley, was discussed.

## CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

| Bids to be opened. | Work. | Place. | See Eng. News. |
|---|---|---|---|
| Jan. 18. | Dredging, etc., | Philadelphia, Pa. | Dec. 27 |
| Jan. 18. | Sidewalk bonds, | Pleasant Ridge, O. | Dec. 27 |
| Jan. 18. | Pipe sewers (24,651 ft.), | Watertown, Wis. | Jan. 10 |
| Jan. 19. | Water bonds ($3,500), | Elysian, Minn. | Jan. 10 |
| Jan. 19. | Pipe sewer, | Tippecanoe, O. | Jan. 10 |
| | Advertised, Eng. News, Jan. 10. | | |
| Jan. 19. | Booms (4,000 ft.), | Ottawa, Ont. | Jan. 17 |
| Jan. 21. | Laying water pipe, | New Orleans, La. | Dec. 27 |
| | Advertised, Eng. News, Dec. 27 to Jan. 17. | | |
| Jan. 21. | Cast iron pipe (42 to 16-in.), | Cleveland, O. | Dec. 27 |
| Jan. 21. | Street Ry. franchise, | Hartwell, O. | Dec. 27 |
| Jan. 21. | Bridge bonds ($200,000), | Toledo, O. | Dec. 27 |
| Jan. 21. | Water-works system, | Milan, Ill. | Dec. 27 |
| | Advertised, Eng. News, Dec. 27 to Jan. 10. | | |
| Jan. 21. | Railway trestle (2,000 ft.), | New York | Jan. 3 |
| Jan. 21. | Pipe sewer, | Fargo, N. Dak. | Jan. 3 |
| Jan. 21. | Electric light plant, | Boston, Mass. | Jan. 10 |
| Jan. 21. | Telephone and electric plants, | Boston | Jan. 10 |
| Jan. 21. | Plans for filter beds, | Victoria, B. C. | Jan. 10 |
| Jan. 21. | Plans for city hall, | Chattanooga, Tenn. | Jan. 17 |
| Jan. 22. | Brick sewers, | Buffalo, N. Y. | Jan. 10 |
| Jan. 22. | Water-wks. extensions, | New York | Jan. 10 |
| Jan. 22. | Bridge, | Buffalo, N. Y. | Jan. 10 |
| Jan. 22. | Pipe sewers, | Buffalo, N. Y. | Jan. 10 |
| Jan. 22. | Pipe, lead, etc., | New York | Jan. 10 |
| Jan. 23. | Electric light franchise, | Winnipeg, Man. | Dec. 6 |
| Jan. 23. | Gas franchise, | Winnipeg, Man. | Dec. 6 |
| Jan. 23. | Tow and dredge boat, | St. Louis, Mo. | Dec. 27 |
| | Advertised, Eng. News, Dec. 27 to Jan. 10. | | |
| Jan. 23. | Water-wks. system, | Decatur, Mich. | Jan. 17 |
| Jan. 24. | Sale | Hamilton, Ont., Bridge Co.'s plant. | Dec. 20 |
| | Advertised, Eng. News, Dec. 20 to Jan. 17. | | |
| Jan. 24. | Dredging machinery, | Portland, Ore. | Dec. 27 |
| | Advertised, Eng. News, Dec. 27 to Jan. 17. | | |
| Jan. 24. | Building materials, | Newark, N. J. | Jan. 3 |
| | Advertised, Eng. News, Jan. 3 and 10. | | |
| Jan. 24. | Water-wks. materials, | Shelby, Mich. | Jan. 10 |
| | Advertised, Eng. News, Jan. 10 and 17. | | |
| Jan. 25. | Asphalt paving, | Ottawa, Ont. | Dec. 27 |
| Jan. 26. | Sewer bonds, | Bennington, Vt. | Jan. 17 |
| Jan. 28. | City college building, | Baltimore, Md. | Jan. 17 |
| Jan. 29. | Paving, | Cincinnati, O. | Jan. 10 |
| Jan. 30. | Piles, brush and stone, | St. Louis, Mo. | Jan. 10 |
| Jan. 31. | Water-wks. extensions, | New Orleans. | Jan. 10 |
| | Advertised, Eng. News, Jan. 10 to 24. | | |
| Jan. 31. | Building work, | Washington, D. C. | Jan. 10 |
| | Advertised, Eng. News, Jan. 10 and 17. | | |
| Jan. 31. | Steel bridge, | Providence, R. I. | Jan. 10 |
| | Advertised, Eng. News, Jan. 10 and 17. | | |
| Jan. 31. | Pier work, | New York, N. Y. | Jan. 17 |
| Feb. —. | Electric light franchise, | Staunton, Ill. | Jan. 17 |
| Feb. 1. | Electric lighting, | Corry, Pa. | Dec. 13 |
| Feb. 1. | Water supply, | Corry, Pa. | Dec. 13 |
| Feb. 1. | Gas plant, | Peoria, Ill. | Dec. 27 |
| | Advertised, Eng. News, Dec. 27. | | |
| Feb. 1. | Electric light plant, | Peoria, Ill. | Dec. 27 |
| | Advertised, Eng. News, Dec. 27. | | |
| Feb. 1. | Steel swing bridge, | Port Huron, Mich. | Jan. 3 |
| Feb. 1. | Paving, | Sandusky, O. | Jan. 10 |
| Feb. 1. | Pipe, valves, etc., | Cleveland, O. | Jan. 10 |
| Feb. 4. | Bridge, | Natchez, Miss. | Dec. 13 |
| Feb. 4. | Paving bonds ($31,400), | Covington, Ky. | Jan. 3 |
| Feb. 4. | Electric plant, | Crowley, La. | Jan. 10 |
| Feb. 4. | Water bonds, | Dunlap, Ia. | Jan. 17 |
| Feb. 4. | Sewers, | Washington, D. C. | Jan. 17 |
| | Advertised, Eng. News, Jan. 17 and 24. | | |
| Feb. 4. | Dredging, | Philadelphia, Pa. | Jan. 17 |
| Feb. 4. | Water-wks. system, | Crowley, La. | Jan. 17 |
| Feb. 5. | Water-wks. system, | Fort Plain, N. Y. | Jan. 17 |
| | Advertised, Eng. News, Jan. 17 and 24. | | |
| Feb. 5. | Sewer, | St. Louis, Mo. | Jan. 17 |
| Feb. 5. | Water-wks. system, | Beaver Falls, Pa. | Jan. 17 |
| | Advertised, Eng. News, Jan. 17 and 24. | | |
| Feb. 5. | P'mps, filter plant, etc., | Beaver Falls | Jan. 17 |
| | Advertised, Eng. News, Jan. 17 and 24. | | |
| Feb. 6. | Water-wks. system, | Canton, Miss. | Jan. 17 |
| Feb. 6. | Heat'g & vent'l'g app., | St. Albans, Vt. | Jan. 17 |
| | Advertised, Eng. News, Jan. 17 and 24. | | |
| Feb. 6. | Iron bldg. work, etc., | Mansfield, O. | Jan. 17 |
| Feb. 7. | Street improvements, | Avondale, O. | Jan. 17 |
| Feb. 9. | Building plans, | Dallas, Tex. | Jan. 3 |
| Feb. 9. | Water-wks. extensions, | New Orleans. | Jan. 10 |
| | Advertised, Eng. News, Jan. 10 to 31. | | |
| Feb. 11. | Jail, | Beaumont, Tex. | Dec. 13 |
| Feb. 11. | Stand-pipe, etc., | Dunlap, Ia. | Jan. 17 |
| Feb. 11. | Electric wiring, | Dallas, Tex. | Jan. 17 |
| Feb. 14. | Enlarging asylum, | Waterbury, Vt. | Jan. 17 |
| Feb. 14. | Pub. bldg. work at | New Berne, N. C. | Jan. 17 |
| | Advertised, Eng. News, Jan. 17 and 24. | | |
| Feb. 15. | Stone dam, | Holyoke, Mass. | Dec. 13 |
| | Advertised, Eng. News, Dec. 13 to Jan. 24. | | |
| Feb. 19. | Torpedo boats, | Washington, D. C. | Dec. 6 |
| Feb. 20. | Water bonds ($25,000), | Kamloops, B. C. | Jan. 10 |
| Feb. 20. | Metal work, | Portland, Ore. | Jan. 17 |
| | Advertised, Eng. News, Jan. 17. | | |
| Feb. 20. | Asphalt paving, | Ottawa, Ont. | Jan. 17 |
| Jan. 21. | Sewer basins, | Brooklyn, N. Y. | Jan. 17 |
| Jan. 22. | Sewer supplies, | Columbus, O. | Jan. 17 |
| Jan. 22. | Iron bridge, | Des Moines, Ia. | Jan. 17 |
| Jan. 24. | Water-wks system, | Carrollton, Ky. | Jan. 17 |
| No date. | Railway in Arkansas (20 miles). | | Jan. 17 |
| | Advertised, Eng. News, Jan. 17. | | |

### RAILWAYS.

#### East of Chicago.

BOSTON & MAINE.—Engineers are reported as at work making surveys and estimates for relaying the Eastern Division of this road with heavier rails and making other contemplated improvements.

BOSTON & NOVA SCOTIA COAL.—Halifax, N. S., papers state that the Boston & Nova Scotia Coal & Ry. Co. has contracted with Dawson & Chaplin, of St. Catherine's, Ont., to build and equip its railway from Orangedale to Broad Cove, and that the financial arrangements have been completed for beginning the construction at once.

DELAWARE & HUDSON CANAL.—This company built 4.7 miles of new road in 1894, of which 4.25 miles was the Ausable branch, built by J. J. Rogers Co., Ausable Forks, N. Y. Engrs., Chappell & Burke, Rutland, Vt.

DOMINION COAL.—The first train over the Dominion Coal Co.'s new railway between Sydney and Louisburg, N. S., was run Jan. 13.

FITCHBURG.—The Manchester, N. H., board of trade is assisting this company to secure favorable action by the legislature of the bill granting a charter for the extension of the Milford & Brookline road, from Milford to Manchester. Such an extension would give Manchester a more direct route to the West, over the Fitchburg, and the extension is opposed by the Concord & Montreal and the Boston & Maine companies.

INDIANA MINERAL SPRINGS.—Press reports from Muncie, Ind., state that work will soon begin upon the construction of a short line railway between Covington and the Indiana Mineral Springs hotel in Fulton county, Ind. The road will be four miles long and the rolling stock will be the steam motors and passenger coaches that did service upon the Muncie street railway until recently.

KANONA & PRATTSBURG.—This railway is in operation from Kanona to Pratisburg, N. Y., a distance of about 12 miles, and there is talk of extending the line through Italy, Shearman's Hollow, and other places to Branchport and thence to Penn Yan, N. Y., a distance of about 20 miles. Secy., Jay K. Smith, Prattsburg, N. Y.

LONG ISLAND.—The contract for building the extension of this railway from Bridgehampton through Easthampton to Amagansett, a distance of 10 miles, has been awarded to Brendlinger & Nearing, of Yonkers, N. Y., and not to Holmes & Coogan, of Jersey City, N. J., as at first reported. About 200 men are at work on the line. The grading and tracklaying is to be completed by May 1, and the bridging by June 1.

NAPOLEON, DESHLER & NORTHWESTERN.—Incorporated in Ohio, Jan. 12, to build a railway from Deshler, in Henry county, to Montgomery, in Williams county, Ohio; capital stock, $50,000; incorporators, M. Donnelly, Robt. K. Scott, W. O. Hudson, J. W. Kanna, D. Meekison, Geo. Eggers, D. W. Humphry and W. P. Tyler; principal office at Napoleon, O.

NEW YORK CENTRAL & HUDSON RIVER.—Walter Katte, Ch. Engr., is quoted in Buffalo, N. Y., as saying that the work of abolishing the grade crossings in that city, to be done by this company, will be begun not later than Feb. 8. He expects to let the contract Feb. 1. The work means an expenditure of many thousands of dollars.

PITTSBURG, BRADY'S BEND & LAKE ERIE.—This company, noted Dec. 20 as incorporated, has filed a profile map of its proposed railway from East Brady through Armstrong and Butler counties to Oneida, Pa., on the Pittsburg, Shenango & Lake Erie. The road will be about 25 miles long and will be built by an eastern syndicate that recently purchased the Brady's Bend mineral lands. Pres., Jos. Pool, New York.

PITTSBURG & NEW YORK TRUNK.—A meeting of railway owners and builders was held in New York Jan. 4, according to reports, to consider a further consolidation of interests, which, it is thought, will insure within two years the operation of another trunk line between New York and Pittsburg. It is the fulfillment of the Beech Creek plan, but will not be known by that name, as this is prohibited under the law through which the sale of the old South Pennsylvania road was effected. It will be formed mainly of a number of independent lines, and after all agreements have been signed a new name will be chosen. The Pittsburg & New York Trunk R. R. is one that has been suggested. At a meeting of the stockholders of three lines in Philadelphia Dec. 28 traffic arrangements and contracts were signed by which Eastern outlets were secured. The agreements will let the trunk line into Buffalo and Rochester, and, by the Vanderbilt connections, to all parts of Canada. By way of the Beech Creek to Lock Haven the line goes over the Reading system to Philadelphia and New York. This will be the main route of the trunk line. It makes a route to New York 91 miles shorter than the Pennsylvania road. The prediction is made that within two years the line will be in operation from Pittsburg to New York. The lines principally interested are the Brady's Bend, the Allegheny & Monongahela, the Beech Creek, the Rochester & Pittsburg and the Vanderbilt system. Included in the general plan is an entirely new line that will tap the Connellsville coke region.

SEBASTICOOK & MOOSEHEAD LAKE.—A bill has been introduced in the Maine legislature authorizing this company to locate a railway from Athens village to some point near Monson Junction, in the town of Abbott, Me.; also to increase its capital stock.

WEST VIRGINIA CENTRAL & PITTSBURG.—It is reported probable that the actual construction of the line between Cumberland and Hagerstown, Md., which has been under consideration for several years, will be commenced by April 1. At the annual meeting of the stockholders of the West Virginia Central & Pittsburg, and Piedmont & Cumberland railway companies, at Cumberland, it was decided to indorse the bonds of the Baltimore & Cumberland Ry. Co. for $3,600,000, the money to be used in extending the West Virginia Central & Pittsburg from Cumberland to Hagerstown with the ultimate view of reaching tide water, either by way of Baltimore or by a connection with the Pennsylvania system by way of Chambersburg, Pa. The stockholders of the three corporations mentioned are almost identical and the interest represented is chiefly the development and disposition of the coal and timber along the line of the West Virginia Central & Pittsburg in West Virginia. Hon. Stephen B. Elkins and ex-Senator Henry G. Davis are the leading stockholders.

#### Southern.

AVON PARK & HAINES CITY.—It is reported that a company has been organized at Avon Park, Fla., to build a tramway to Haines City, a distane of 40 miles; capital stock, $20,000; Pres., O. M. Crosby; Supt., J. C. Burleigh.

CAIRO & KANAWHA VALLEY.—It is stated that this railway was extended in 1894 from Ritchie Mines to McFarlan, W. Va., and that a meeting has been called at Grantsville to consider the question of securing an extension of the line to that point. Pres., H. S. Wilson, Parkersburg, W. Va.

CHARLESTON, SUMTER & NORTHERN.—This railway will be sold on Feb. 15. The road is 140 miles in length. J. E. Hagood, Special Master, Charleston, S. C.

CHICKAWSAHA & JACKSON.—This railway is under construction from Chicora, Miss., northwest about 35 miles to Laurel, on the New Orleans & Northeastern, and the construction is reported as progressing slowly. There are now 13 miles in operation, 5 miles of which were built in 1894 from Graham Mills to Cochran Creek. Secy. and Treas., E. W. Robinson, Chicora, Miss.

#### Northwest.

DULUTH & IRON RANGE.—This company is reported to have awarded a contract to N. Elsburg to build an eight-mile spur from McKinley, Minn., to the Fayal mine. The construction is to be commenced at once.

MARINETTE, TOMAHAWK & WESTERN.—A press report from Tomahawk, Wis., states that 22 carloads of steel rails have arrived in that city for this railway. The work of cutting the right of way is completed to Harrison on the Chicago & Northwestern, a distance of 15 miles and trains will be running from Tomahawk to that point by April 10.

RICE LAKE, DALLAS & MENOMONIE.—The incorporation of the Wisconsin Construction Co. to extend this railway was noted in our issue of last week. It is stated that surveys are now being made from

Cameron to Menomonie, Wis., and that the construction will be commenced as soon as possible in the spring.

WISCONSIN & CHIPPEWA.—The Spirit River extension of this short railway in Wisconsin has been completed for about 10 miles west of Tomahawk, Wis., according to reports.

WYOMING & DAKOTA.—C. D. Crouch, Rapid City, S. Dak., sends us the following information in regard to this road: The Wyoming & Dakota R. R. Co., in conjunction with Wyoming Coal & Coke Co., was organized early in 1894, each consisting of practically the same personnel, and bought the Larabee coal mines of Hay Creek, Cook county, Wyo. The promoters were Geo. M. Nix, of Dubuque, Ia., and Underwood & Green, of Chicago, Ill. A small payment was made on the mine and contract let to the Crouch Construction Co. for a line of railway from a junction of the F. E. & M. V. R. R. at Minnesela, S. Dak., to the mine, 18½ miles distant. The construction was commenced in June, 1894, and work was suspended in August for want of funds. The result was about 7 miles of grade nearly completed. No work has since been done or obligations paid. Payments on mine contract have since been defaulted, and consequently former payments lost. There is no prospect of improved conditions.

### Southwest.

ARKANSAS.—Bids are asked in our advertising columns for building and equipping 20 miles of standard gage railway in Arkansas. A. H. Latimer, 1402 Union Trust Bldg., St. Louis, Mo.

LITTLE ROCK & PACIFIC.—This railway is projected from Little Rock, Ark., to Fort Smith, with a branch to Wister Junction, Ind. T., 230 miles, as stated in our issue of Dec. 20. A proposition to locate the shop at Little Rock, if the city would subscribe $200,000 and donate 40 acres of land, was accepted by the citizens on condition that the money should be returned if the road ever fell into the hands of the Gould interests, or became a part of the Missouri Pacific system. The directors of the company refused to allow this condition, and Gov. W. M. Fishback, Pres. Little Rock & Pacific, has withdrawn the proposition made to the city. It is probable that the assistance asked will be granted with the anti-Gould clause eliminated.

MISSOURI, KANSAS & TEXAS.—This company proposes to build two small lines considered essential to the system, and has called a meeting of the stockholders for Feb. 14 to act on the matter. It is proposed to build a branch of 16 miles from a point near Parsons, Kan., to the Cherokee coal fields, and a gap of about 35 miles connecting the Kansas City and St. Louis divisions. The means for construction will be provided by sale of Missouri, Kansas & Texas first mortgage extension 5% gold bonds, to be created to an amount not exceeding $20,000 per mile of new lines and equipment. It is designed to make this bond a uniform security, to be available to build branches, should any be needed in the future, in the states of Missouri and Kansas or in the Indian Territory.

RIO GRANDE NORTHERN.—G. N. Marshall, Ch. Engr., El Paso, Tex., writes us that the contract for building this railway has been awarded to Kiel & Co., of San Antonio, who are to commence the construction at once and have the entire 26 miles completed in six months. This projected railway has been noted several times recently in these columns.

SOUTHERN CHEMICAL & FERTILIZING.—The Southern Chemical & Fertilizing Co., of New Orleans, La., has petitioned for a franchise for a belt railway to connect the crematory with the slaughter houses, with switch tracks to railways and factories.

ST. LOUIS, COLLINSVILLE & EASTERN.—The grading on this railway between St. Louis and Collinsville, Ill., 11 miles, is reported as well advanced, and tracklaying will probably begin this month. The road will give a direct connection between St. Louis and the Collinsville coal fields and will pass through a rich agricultural district. Berry & Dean, St. Louis, are the contractors for the grading and tracklaying. Pres., J. S. P. Gordon, Collinsville, Ill.; Ch. Engr., Wm. G. Campbell, 822 North 16th St., St. Louis.

VINING & COLEMAN CITY.—A press report states that Jno. W. Maxey, of Maxey & Wood, of Austin and Houston, Tex., is locating engineer of the Vining & Coleman City Ry., which he has just surveyed from a point on the Gulf, Colorado & Santa Fe, 7 miles southwest of Coleman City, to the Vining coal mines on the Colorado River. The profiles and estimates are now being prepared at the Austin office of Maxey & Weed, who are of opinion that work will soon begin on construction. The object of this road is to develop the rich coal fields in that section. Wm. L. Vining, of Austin, is reported as at the head of the enterprise.

### Rocky Mt. and Pacific.

COLORADO.—A press report from Denver, Colo., states that J. T. McWilliams has completed the survey of a railway route from Falstaff, Ariz., to the nearest point on the Grand canyon of Colorado, 35 miles away.

FLORENCE SOUTHERN.—Incorporated in Colorado to build a railway from Florence to Silver Cliff through Oak Creek canyon; capital stock, $1,000,000; incorporators, W. B. Johnson, James A. McCandless, W. K. Johnson, of Florence; O. M. Ladd and J. B. Orman, of Pueblo; H. H. Tompkins, of West Cliff.

GREAT SALT LAKE & HOT SPRINGS.—This company has made surveys from Centerville, Utah, the present terminus of the railway, to Coalville, 52 miles distant, and the plans are to build a road into the coal mines at Coalville, the line running up Weber canyon, and the expectation being to furnish cheaper coal to the Salt Lake market. Three miles of the grade for this extension are now constructed, and the company will build into Farmington early in the year, and the extension to the coal mines will be pushed as rapidly as practicable.

NEVADA SOUTHERN.—It is reported probable that this railway will be completed into Nye county, Nev., early next spring. Ch. Engr., Robt. B. Burns, Williams, Ariz.

OVERLAND PACIFIC.—The contract for building this railway from Fort Bragg, Cal., on the coast, through a timber belt for about 100 miles to the coal field near Ukiah, was awarded nearly a year ago to G. W. Hunt, of Walla Walla, Wash. Mr. Hunt has a $120,000 construction outfit at Fort Bragg, and it is stated that active construction will soon be commenced. The delay is said to have been caused by difficulty in securing the right of way.

RIO GRANDE WESTERN.—In regard to projected work it is stated that the construction of the terminal shops, which was abandoned in July, 1893, will probably be completed during this year in order to comply with the terms of the contract with the people of Ogden, Utah. As to the future intentions of the company, nothing definite can be said. It is its desire to extend to the coast, and some money has been spent in preliminary surveys. A survey for the extension of its San Pete and Sevier line from Salina to Marysvale, a distance of 44 miles, has been on record for two years, and most of the right of way has been secured. Enough rails to make this latter extension have been purchased and are still on hand. It is therefore safe to believe that the only item that interferes with new construction by this company is the depression of the money market.

SALT LAKE & LOS ANGELES.—This railway was built from Salt Lake City to Saltair, 15 miles, a few years age. The Salt Lake City "Tribune" states that the company is about to erect a depot building in Salt Lake City and to extend its tracks to it. The intention of the management of the company is to construct a new line to California by way of the mining districts of Deep Creek and through Nevada, and to go east to Coalville and Grass Creek for a fuel supply. Back of the railway company is the newly-organized Utah Co., capitalized at $10,000,000, and among the assets of the company are some valuable coal lands and partially developed mines lying east of Salt Lake some 50 miles.

SIERRA VALLEY.—A press report states as follows: The new Sierra Valley R. R., which has been completed for a distance of 23 miles, and is projected to cross the Sierras through Beckwith Pass, has been mortgaged to the Southern Pacific. Nevada papers think that the fact that the Southern Pacific is aiding the project indicates that corporation has secured control of the property, with the probable intention of abandoning the Central Pacific line across the Henness Pass route during the winter season, thus avoiding blockades and the heavy cost of maintaining the long line of sheds across the snow belt on that route.

SIERRA VALLEY.—Incorporated Jan. 5, to build a railway from Reno, Nev., to Quincy, Cal., 100 miles; capital stock, $1,000,000, all paid in; incorporators, John H. Platt, Jas. Elder, John F. Little, Fletcher F. Ryer, Wm. S. Kittle, San Francisco; principal office, San Francisco. The road is to begin at Reno, running thence in a northwestern direction to the summit of Beckwith Pass., and thence in a generally westerly direction to the town of Mohawk, and then to a convenient point near the town of Quincy. The new company will endeavor to buy the narrow gage road now running out of Reno.

UNION PACIFIC.—It is expected that the narrow gage line between Salt Lake City and Garfield Beach will be made broad gage this year. Some work was done on this last year, including the laying of 22,000 broad gage ties. The Salt Lake City "Tribune" states that the prospective improvements for this year are a new depot at Leamington, and a new bridge across the Jordan River on the Salt Lake & Western line. It is not probable that any new lines or extensions will be constructed during 1895, although the management have several schemes for extension before them. Among these is an extension of the Utah & Nevada line from Terminus over the hill to Stockton and around to the new Mercur district; also the completion of the Milford extension, 160 miles of the grade for which was constructed in 1890. The broadening of the gage of the Utah & Nevada referred to is likely to be the most important work undertaken.

### Foreign.

CHILE.—Press reports state that two new railway lines are about to be constructed. One line, for the building of which 21 mercantile firms are asking concessions from the government, will unite Patillos with the nitrate fields of Tarapaca. A concession has already been granted for the other line, which will connect the districts of Quilpue and Melipilla with the central railway between Santiago and Valparaiso.

### STREET AND ELECTRIC RAILWAYS.

ATHENS, ME.—It is reported that Walter Murphy and Harry Boardman are to make surveys for an electric railway which is to be built between Skowhegan and this place.

YARMOUTH, ME.—Ilsley & Cummings are making surveys for an electric railway to Yarmouthville.

SOUTH HAMPTON, N. H.—F. M. Jewell, G. M. Buxton and J. M. Carr are interested in a project for an electric railway between Amesbury, Kingston and this place, and have petitioned the legislature for a charter, according to reports.

BOSTON, MASS.—The Meigs Elevated Ry. Co. is reported as to petition the aldermen Jan. 21 for locations on over five miles of streets. The act of incorporation of the company calls for a deposit of $300,000 one month after approval of locations, and $200,000 when work of construction commences.

SPRINGFIELD, MASS.—The Springfield St. Ry. Co. is reported about to petition for permission to extend its electric line to Holyoke. Pres., John Olmsted; Treas., A. E. Smith.

BRIDGEPORT, CONN.—The Bridgeport Traction Co., Supt., A. Radel, is reported about to purchase another large engine, as the present equipment is not sufficient to operate all the line properly when there is snow on the ground.

NEW LONDON, CONN.—The New London & Norwich Electric Ry. Co. will soon be incorporated with a capital stock of $200,000, according to reports, and will begin the construction of its line at an early date.

BATAVIA, N. Y.—Press reports state that the contract for building and equipping the Waterport Electric Light, Power & Ry.'s bicycle railway has been awarded to the Equipment Construction Co., and it is to be in operation between Waterport and Lakeside by June 1. The equipment between these points will consist of three motor cars and five trailers. Orders for the cars and motors have already been placed and track material ordered. The company has adopted the Beecher system after a thorough trial of the storage battery car for over two weeks running daily through the late blizzard with heavy snow on an icy track and a heavy gale blowing every day, giving a severe test under the most unfavorable circumstances, and at no time with a load of less than 20 passengers, attaining a speed from 12 to 20 miles per hour; nor at any time did the car take over 3 HP., and it is said to be capable of running 200 miles on one charge of the batteries. The car weighs less than three tons with the batteries and motor complete.

ELMIRA, N. Y.—It is reported that the West Side R. R. Co. will extend its Sullivan St. electric line on several streets in the spring.

LAKE GEORGE, N. Y.—The Horicon Improvement Co. has been incorporated to build a cable road to the top of Prospect Mountain, a distance of 72,000 ft., and to own and conduct the Lake House Hotel, at Lake George, and build and maintain cottages on the Lake House grounds; capital stock, $150,000; directors, Walter M. Peck, Harry M. Peck and A. B. Colvin, all of Glens Falls, N. Y.

LIBERTY, N. Y.—Mr. Van Cleft, of Newburg, is reported as interested in a project to construct an electric railway up the Neversink Valley, from Fallsburg to Monticello. Most of the right of way has been secured and $65,000 of the capital stock subscribed.

LOCKPORT, N. Y.—It is reported that Chicago capitalists propose to construct an electric railway from this city to Olcott.

NEW YORK, N. Y.—The Metropolitan Traction Co. is reported as to issue $6,000,000 in bonds to place cables in 23rd and 34th Sts. and to extend the Ninth Ave. cable line southward.——The Third Ave. R. R. Co. has petitioned the aldermen for permission to extend its lines. Pres., A. J. Elias.

WATERTOWN, N. Y.—The Watertown & Brownville St. Ry. Co. is to extend its electric line from Brownville to Dexter, a distance of two miles. This branch will be known as the Dexter St. Ry. Work will commence June 1, and when completed will connect Watertown with Dexter, a distance of seven miles.

YONKERS, N. Y.—It is stated that the Yonkers St. Ry. Co. proposes to build in the spring a 4,000-HP. electric plant to furnish power for its lines to Hastings and other parts of the county. Gen. Man., J. J. Coleman.

CAMDEN, N. J.—It is probable that the Camden, Gloucester & Woodbury Electric Ry. Co. will extend its line to Glassboro in time for the summer travel. The citizens of Blackwood are about to petition the company to extend its line to that place.

SOUTH ORANGE, N. J.—The Central Jersey Traction Co. and the New Jersey St. Ry. Co. have applied for franchises on Springfield Ave.

UNION, N. J.—The township committee has granted a horse car and electric franchise to a company which proposes to build a line from Kearney, through Rutherford, to Hackensack.

GREENSBURG, PA.—The Westmoreland & Allegheny Traction Co. has applied for a charter for an electric railway. The company has already secured right of way through Penn and Manor. The line will begin at this place and pass through Jeannette, Penn, Manor, and Irwin, to Wilmerding, where it will connect with the Second Ave. Traction Co.'s lines. A. W. Mellon and S. D. Mitchell, Pittsburg, and M. L. Painer and E. H. Blair, Greensburg, are interested.

MECHANICSBURG, PA.—The Cumberland Valley Traction Co. has been granted a franchise for the construction of its electric line through the main street of this place.

PHILADELPHIA, PA.—Press reports state that the Pennsylvania R. R. Co. will begin work in a few days on the construction of an electric railway between Mount Holly and Burlington, N. J., a distance of seven miles. It will use the tracks which for a number of years have been operated by steam, and it forms a connecting link between the seashore road and Mount Holly and the Camden & Amboy line at Burlington. The transferring of this line into a trolley one is done for two things—one, to give better service, and the other, to test the electrical system on railways. If it is a success as far as the latter object is concerned, it is presumed that a number of the branch lines, on which there are only one or two trains a day, will be converted into electric lines, and in this way will be able to compete with the electric railways.——The board of surveys has granted a franchise to the West Chester Road Co. for the construction of an electric line on Market St.——The plans of the Citizens' East End Passenger Ry. Co. for tracks on several streets have been approved.

PHILADELPHIA, PA.—The Pennsylvania Traction Co., Pres. J. J. Patterson, Lancaster, and the Philadelphia Traction Co., represented by the Elkins & Widener syndicate, have made traffic arrangements for entrance to this city, the connection to be made at the Philadelphia county line. To make the necessary connection the Philadelphia company will build from 63d St. to the county line, there connecting with the Pennsylvania Traction line. The contract for building a road from the Philadelphia county line to Coatesville, by way of West Chester and Downingtown, will be given out within a few days, and the work will be rapidly pushed. It will be a double track road, and will be built on private property, the right of way having already been secured by the Pennsylvania Traction Co.

READING, PA.—Press reports state that the Reading & Womelsdorf Ry. Co. has entered into a contract for the construction of its entire line on the western bank of the Schuylkill River, opposite this city, to Womelsdorf, on the line of the Berks and Dauphin Turnpike, with the Lancaster Electrical Construction Co., of Lancaster. The contract includes grading, laying of rails, erection of poles and stringing of wires, ready for operation, and it provides that the road shall be completed by June 14. The line is 14 miles long, and will connect at the western end of the bridge with the tracks of the Reading Traction Co., provided the litigation now going on upon that question is decided favorably to the latter. The company

has secured the right of way from the turnpike company.

SHENANDOAH, PA.—The Lehigh Valley Coal Co. has granted the Lakeside Electric Ry. Co. permission to construct a line on its land from Delano to Lakeside. Construction will begin at once and the line may be in operation by June.

YORK, PA.—The following companies propose to build electric railways through York county: York & Dover Electric Ry. Co., York & Manchester Electric Ry. Co., York & Wrightsville Electric Ry. Co., and the York & Dallastown Electric Ry. Co. W. H. Lannis is president of these companies; directors, Grier Hersh, G. S. Billmeyer, L. A. Marshall, and J. W. Steacy.

ANNAPOLIS, MD.—The Annapolis, Brighton Beach & Bay Ridge Ry. Co. has petitioned for a franchise for an electric railway.

BALTIMORE, MD.—The Edmondson Ave., Catonsville & Ellicott Cy. Ry., noted last week, is to be constructed with a view of connecting at some future time with the proposed Baltimore & Washington Boulevard Electric Ry. The company is negotiating with Charles Livesey for the purchase of a tract of land at Ingleside and Edmondson Aves., on which to build an electric power house. The lot in view fronts 400 ft. on Edmundson Ave. and 200 ft. on Ingleside Ave.

WASHINGTON, D. C.—The Eckington & Soldiers' Home Ry. Co. has petitioned for an amendment to its charter for an extension of its lines.——The Rock Creek Ry. Co. has petitioned for authority to change its name to the Capital Traction Co. and to extend its electric line.

ALEXANDRIA, VA.—The Foreign Electric Traction Co. has been incorporated to buy and sell patents for electric railways, lights, etc.; capital stock, $1,000,000; Pres., W. H. Stewart, Washington; Vice-Pres., Eppa Hunton; G. H. Norton, Jr., will represent the company in this city.

CHARLOTTESVILLE, VA.—A correspondent writes us that the Charlottesville City & Suburban Electric Ry. is now in operation. The line is two miles in length. Gen. Man., T. O. Troy; W. H. Chapman, Boston, is the superintendent of the work of equipping the line with electricity; Engr., C. E. Dickinson.

ATLANTA, GA.—It is reported that the Atlanta Consolidated St. Ry. Co. will erect new power houses and extend its lines, at an estimated cost of about $100,000. Pres., Joel Hurt.

VICKSBURG, MISS.—Press reports state that a final decree has been entered in the suit of J. H. Benedict, New York, vs. the Vicksburg Electric St. Ry. Co., giving judgment for the plaintiffs for $15,000 and ordering the sale of the company's franchise, real estate, track, rolling stock, etc., after 60 days' advertisement, unless the judgment is satisfied within 30 days.

CLEVELAND, O.—The Cuyahoga Suburban Ry. Co. has increased its capital stock from $10,000 to $50,000. Pres., John Mitchell; Secy., Charles C. Thompson.

ELYRIA, O.—According to press reports the farmers of Lorain and Erie counties are preparing to construct an electric railway from Milan, Erie county, to Elyria, a distance of 20 miles. The right of way has been secured for nearly the entire distance. The road is to cost $225,000, and will go through the towns of Berlinville, Florence, Birmingham, Henrietta, and South Amherst. There are a large number of truck farmers along the route who will be given access to the Elyria and Cleveland markets in connection with the Cleveland-Elyria line. The road will cost less per mile than any electric line in Ohio. It will strike several inland towns which have no railway facilities now.

HILLSBORO, O.—The Hillsboro R. R. Co. has been incorporated with a capital stock of $5,000, to construct a line between Hillsboro and Sardinia; incorporators, J. Y. Dean, J. E. McDermott, E. L. Ferris, Jas. T. McGuire, and others.

LAKESIDE, O.—Geo. P. Keeper, Cincinnati, is interested in a projected electric railway between this place and Tiffin. It is expected to have the line in operation to Fremont by July 1. A power house will be built at Port Clinton.

LIMA, O.—An ordinance has been passed establishing the College St. Ry. route in several streets. C. E. Lynch, Cy. Clk.

ANDERSON, IND.—Press reports state that the Anderson, Alexander & Marion Electric Ry. Co. has ratified the contract for the construction of its line, which was recently noted as awarded to C. E. Loss & Co., Chicago. The first branch of the road is to be built between Anderson and Marion by Sept. 1. The directors of the company say they have secured the right of way through Madison and Grant counties to the Marion county line. Pres., F. M. Dice; Vice-Pres., Noah J. Clodfelter; Treas., Charles A. Miller.

PAW PAW, MICH.—It is reported that a Detroit firm has offered to build an electric railway between this place and Lawton, to be in operation by July.

SPRINGWELLS, MICH.—The Detroit & Dearborn Traction Co. has petitioned for a franchise for its electric line on Michigan Ave. E. T. Hance and J. A. Russell are interested.

TRAVERSE CITY, MICH.—Surveys have been completed for the Traverse City, Peninsula & Old Mission Electric Ry. Co.'s line from Bowers Harbor to Tompkins' Lake and Old Mission.

CHICAGO, ILL.—The Ogden St. Ry. Co. has petitioned for a 20-year franchise for an electric or cable line on several streets.——The Northern Electric Ry. of Chicago, running from a connection with the Lake St. Elevated Ry. in West 47th and West 48th Sts., through the towns of Cragin and Hanson Park, a distance of six miles, is now under construction, and will be in operation March 1. Pres., Paul Dickinson; Geo. M. Huss, Lakeside Building, Chicago, contractor for the construction of the line.

DECATUR, ILL.—Press reports state that the Decatur Electric St. Ry., 12 miles in length, with good equipment, may be sold in a few days to a Chicago syndicate. C. F. Taylor and R. W. Yates, representing the syndicate, have been making a careful inspection of the property and books. The principal Decatur stockholders are David S. Shellabarger, W. L. Shellabarger, and W. L. Ferguson.

VENICE, ILL.—The Granite City, Madison, Venice & Brooklyn St. Ry. Co. has applied for a charter for its proposed electric line, according to reports, and the construction will be commenced as soon as possible.

BARABOO, WIS.—It is reported that an electric railway may be built between Devil's Lake and the Dells, passing through this city. Capitalists are looking over the field, and if arrangements can be made work will soon begin. A few years ago the right of way was secured, and a franchise to build through the city is now held by Marsh & Jackson, who are working on the project.

MILWAUKEE, WIS.—The Milwaukee & Wauwatosa Motor Ry. Co. has petitioned for a franchise on several streets to enable the company to connect Wauwatosa and North Greenfield with this city. Pres., Pames Petley; Secy., A. B. Myers.

CENTRALIA, KAN.—The Centralia, Seneca & Pawnee Electric Ry. Co. has been incorporated to establish and maintain an electric motor railway between Centralia and Seneca; capital stock, $200,000; directors, A. W. Slater, J. C. Clark, S. W. Burtch, A. L. Coleman, John S. Hidden, F. A. Stickel and W. S. Domer, Centralia; R. M. Emery and A. Wells, Seneca.

CLAYTON, MO.—St. Louis & Jefferson Barracks St. Ry. Co. has been incorporated with a capital stock of $30,000; incorporators, Claud Kilpatrick, W. R. Davis and J. S. Minory.

ST. LOUIS, MO.—The Pine St. & Manchester R. R Co. has applied for a franchise.

PUYALLUP, WASH.—The council has granted the Tacoma Traction Co. a 25-year franchise to extend its electric line from Park Ave. to the Northern Pacific R. R.

NEW WESTMINSTER, B. C.—The property of the Westminster & Vancouver Tramway Co. is to be sold at auction April 13. Address, G. E. Corbould, Solicitor for the Montreal Safe Deposit Co.

## ELECTRIC LIGHT AND POWER.

PORTSMOUTH, N. H.—The construction of an electric light plant by the city, estimated to cost $150,000, is being discussed.

NORTHFIELD, VT.—An election was held Jan. 14 to vote on the question of granting an electric light franchise to G. R. Andrews.

RUTLAND, VT.—The construction of a municipal electric light plant is being discussed. A company is reported as having proposed to furnish lights at $112.50 for each arc light per year, and incandescent lights at 7½ cts. per night, to burn all night, contract to be for ten years. This rate is considered too high.

CAMBRIDGE, MASS.—The establishing of a municipal electric light plant continues to be discussed.

LANCASTER, N. Y.—It is reported that an electric light company is being organized. J. M. Greis is interested.

HIGHTSTOWN, N. J.—A. S. Voorhees, Secy. Com., writes us that it is proposed to issue $10,000 in bonds for an electric light plant. It is necessary for owners of one-half of the taxable property to sign a petition to order an election to decide the matter.

BELLWOOD, PA.—The Bellwood Electric Light Co. will probably put in a new boiler and engine in its plant.

NEW CASTLE, PA.—The council is investigating the advisability of putting in a municipal electric light plant.

SOUTH WILLIAMSPORT, PA.—It is reported that this place will have an electric light plant.

WERNERSVILLE, PA.—Edgar B. Kay, Wernersville, has been engaged to design and construct a water-power and electric light plant for Walters Park Sanitarium, at Wernersville. The plant will include about 2,000 ft. of cast iron pipe, masonry reservoir, 40-HP. turbine wheel, and direct current dynamo; also about 300 incandescent lights and 6 arc lights.

BALTIMORE, MD.—It is reported that the contract for lighting the Belt Line tunnel with 900 incandescent lights has been awarded to D. E. Evans & Co. They will be strung along the sides of the tunnel and will be kept constantly burning, avoiding the necessity for using the headlights on the electric motors in making the underground trip. The electricity for supplying the lights will be furnished from the same power house which supplies that for hauling trains. The machinery equipment for the tunnel power house will be delivered by Feb. 1. The equipment at first will be four engines, with a capacity of 750 HP. each, and four smaller ones of 250 HP. each. Ample room will be provided for increasing this capacity by the addition of more engines should it be found necessary when the tunnel is used for trains. The large engines are being made by the E. P. Allis Co., Milwaukee, and the smaller ones by the Armington & Sims Co., Providence, R. I.

MOUNT STERLING, KY.—J. P. Martin, Xenia, O., has made arrangements with the city for the erection of an electric light plant and for an electric railway. It is stated that water power will be used eight months of the year and steam the other four months. Mr. Martin is reported as receiving bids for the complete equipment for an electric light and power plant for a street railway, including dynamos for 50 to 100 arc lights, 30 to 50 commercial arc lights and alternating capacity for 1,500 to 2,000 incandescent lamps of various candle power.

BLOOMFIELD, IND.—Press reports state that the business men of Bloomfield, Worthington and Linton are talking of putting in an electric light plant at Switz City to supply the three towns. Switz City is a small town on the Indiana & Illinois R. R., and is six miles distant from each of the three towns named.

BELLAIRE, MICH.—Electric lights are to be put in at this place, according to reports.

BERRIEN SPRINGS, MICH.—The Berrien Springs Water & Power Co. has been granted a franchise to construct a dam across the St. Joseph River at this place. The dam will be 16 ft. high, and is expected to supply 8,000 HP. The work of construction will probably begin about April 1. Pres., Geo. H. Murdock; Secy., Fred. McComber.

MENDON, MICH.—Frank Avis, of Hudson, has been awarded a contract to light the streets of this place with 10 arc lights and the houses with incandescent lights.

BUNKER HILL, ILL.—The lighting of this place by electricity is being discussed. A. R. Sawyer is interested.

CASSVILLE, ILL.—It is reported that the question of lighting the streets of this place with electricity is being considered.

EARLVILLE, ILL.—Arrangements are being made to put in an electric light plant, according to reports.

LEWISTOWN, ILL.—It is reported that arc lights will be put in at once to light the streets.

STAUNTON, ILL.—Bids are asked by the council until the first meeting in February for a franchise for an electric light plant, according to reports.

SYCAMORE, ILL.—The Sycamore Electric Light Co. is considering adding new boilers and new engine to its plant, and of moving it to a more convenient location.

RICHMOND, WIS.—The citizens are reported as dicussing the question of putting in an electric light plant.

WEST SUPERIOR, WIS.—The Altamonte Water Power Co. has entered into contract with the mayor for the transmission of power to this city. The company has also a contract for supplying power in Duluth.

ROCK RAPIDS, IA.—Press reports state that the plant of the Rock Rapids Water Co. has been sold by the Reeves estate to Joel W. Hopkins, of Granville, Ill., who will probably add an electric light plant if a franchise can be secured from the city. The town has no lights of any kind on its streets, and the people generally are in favor of lights of some kind, and favor electric lights.

RICHMOND, MO.—An election will be held Jan. 28 at which, it is reported, that the question of electric lights will be voted upon.

CLEBURNE, TEX.—It is reported that the Brownwood Electric Light Co. has accepted a proposition from this city to move its plant from Brownwood to this place.

HEMPSTEAD, TEX.—The council is reported as considering an offer of outside capitalists to put in an electric light plant in this city.

DALLAS, TEX.—Bids are asked until Feb. 11 for placing electric wires in the Dallas county court house. T. F. Marsh, County Judge.

SAN FRANCISCO, CAL.—H. H. Taylor has been granted a franchise to lay pipes in the streets for furnishing light in competition with the Edison Electric Light & Power Co., in the district about Market St. Mr. Taylor is a nephew of D. O. Mills, who is supposed to be interested.

SALT LAKE CITY, UTAH.—The Big Cottonwood Power Co. has made a contract with the Salt Lake & Ogden Gas & Electric Light Co., by which the former company is to supply the latter with power to light this city after Sept. 1, 1895. The company will transmit 1,500 to 2,500 HP. to this city.

RENFREW, ONT.—M. L. Russell and an Ottown electric light company are interested in a project to put another electric light in this place, according to reports.

NEW COMPANIES.—Nantucket Electric Co., Nantucket, Mass.; $20,000; Pres., Fred. H. Porter, 642 Exchange Bldg., Boston; Treas., John R. Bacon.

Cascade Electric Light & Power Co., Berlin, N. H.; $15,000.

Electric Purifier Co., Chicago, Ill.; $300,000; Geo. H. Reynolds, A. B. Jenkins, W. T. Rankin.

Empire Light & Power Co., Quincy, Ill.; $25,000; W. H. Charmon, J. P. Wheeler, I. L. Faucett.

County Electric Light & Power Co., Clayton, Mo.; $5,000; M. B. Greenfulder, E. W. Warfield.

Spiral Wire Co., Portland, Me.; $1,000,000; to furnish light, heat and power; Pres., W. G. Burnham, Boston; Treas., James W. Briggs, Boston.

Phoenix Telephone & Electric Co., Denver, Colo.; $750,000; Gwnisly Walker, P. H. Baker, Denver; G. C. Schofield, L. London, New York, N. Y.

Maine Water & Electric Power Co., Wiscasset, Me.; William Dol, Duke Center, Pa.; J. H. Links, Williamsport, Pa.; Henry Ingalls, Wiscasset, Me.; C. P. Collins, Bradford, Pa.

West Shore Electric Light Co., Fort Lee, N. J.; $100,000, with $1,000 paid in; John A. Dempsey, New York, N. Y.; Leon Abbett, Jr., Hoboken, N. J.; R. W. S. Negus, Bogata, N. J.

Pacific Mineral Reduction Co., San Francisco, Cal.; $1,000,000, with $50,000 paid in; to build and operate electric light plants and supply power; T. J. Ryan, Geo. W. Waits, F. M. Johnson.

American Electric Meter Co., Camden, N. J.; $100,000, with full amount paid in; to manufacture and put in electric meters and to build and operate electric railways and light, heat and power plants; Wm. D. Marks, W. F. Smith, James F. Gray, Philadelphia; Charles Wirt, Chicago, Ill.; Martin V. Bergen, Jr., Camden; Chas. L. Edgar, Boston, Mass.

## BRIDGES.

DIXFIELD, ME.—The contract for building an iron and steel bridge across the Androscoggin River at this place has been awarded to the Geo. E. King Bridge Co., according to press reports.

NEW HAVEN, CONN.—The citizens of Fair Haven have petitioned for a drawbridge over the Quinnigiac River at Grand Ave.

NEW YORK, N. Y.—The Pencoyd Iron Works have been awarded the contract for the superstructure of the bridge to be built across the East River, between this city and Brooklyn, by the New York & Long Island Bridge Co. There were five bids considered. The contract calls for about 35,000 tons of metal. The work was described in our issue of Nov. 24. Work on the foundations has been in progress for some time. Ch. Engr., Chas. M. Jacobs, 192 Broadway.

PITTSBURG, PA.—The Aspinwall Bridge Co. was incorporated Jan. 14 to build a bridge over the Allegheny River from Central Ave., Aspinwall, to Butler

St. extension, Highland Park, this city; capital stock, $1,000, commencing with $100; Treas., J. W. Patterson, 306 Amber St.

BEAVER FALLS, PA.—The Steubenville & West Virginia Bridge Co., of this city, was incorporated in West Virginia June 12 to build a bridge across the Ohio River at Steubenville, O.; capital stock, $200,000, of which $2,000 is paid in; incorporators, S. P. White, T. S. White, J. F. Mitchell and G. D. Douglass, of New Brighton, Pa., and C. C. Baker, of Alliance, O.

NORRISTOWN, PA.—Efforts are being made to secure another bridge over Stony Creek, at a cost of $50,000 to $60,000. It is stated that the citizens do not wish to bear all the expense, and that the county commissioners are not favorable to the project at this time.

BALTIMORE, MD.—All bids for an iron draw-bridge over Bear Creek have been rejected by the county commissioners.

ATLANTA, GA.—The bridge committee has recommended that the Alabama St. bridge, estimated to cost $100,000, and the Broad St. bridge, to cost $25,000, be built as soon as possible.

SHEFFIELD, ALA.—The House commerce committee has reported favorably a bill for a bridge across the Tennessee River at this place.

DANDRIDGE, TENN.—We are informed that the county court will build an iron or steel wagon and passenger bridge across the river at this place; length of span, 800 ft. A. H. Webster, Chn. Com.

BELLAIRE, O.—Several bridges were carried away by high water last week, including two on the Cleveland, Lorain & Wheeling Ry.

NEW PHILADELPHIA, O.—The new bridge across the river at Goshen, leading to the Lehns Valley coalfields, was carried away by an ice gorge.

BEDFORD, IND.—A railway bridge on the Monon road near this city was washed away last week, and the high water is reported to have done a large amount of damage in Southern Indiana.

INDIANAPOLIS, IND.—The contract for a bridge over Pleasant River at Madison Ave. has been awarded to the Youngstown Bridge Co., at $3,250.

RICHMOND, IND.—A press report states that the old bridge spanning White River at the crossing of Whitewater River, built by the government in 1834, has been condemned and closed against traffic. This is one of the oldest bridges in the country, and was built along the line of the old National road.

GORDON, WIS.—A contract for a 320-ft. iron bridge across Black River at Gordon's Ferry has been awarded to the Chicago Bridge & Iron Co., at $4,908, exclusive of approaches.

DES MOINES, IA.—Bids are asked until Jan. 22 for constructing an iron bridge over Four Mile Creek, including stone abutments. Ed Wright and John Sherman, Bd. Pub. Wks.

DULUTH, MINN.—Press reports state that the Northern Pacific bridge, 1¼ miles long between Duluth and Superior, is to be rebuilt and widened to accommodate a double track. The preliminary work of reconstruction commenced Jan. 8. The approaches and structural work between draws will be doubled in strength, and while the bridge is amply strong in its present shape, the work of reconstruction and filling in will increase its capacity 100%. This bridge has two draw spans 300 ft. in length each, and handles all the railway traffic between this city and Superior, except what goes over the Grassy Point bridge.

ST. PAUL, MINN.—The city engineer has been directed to make plans for an iron bridge 60 ft. wide across the Great Northern tracks on Como Ave.

LEAVENWORTH, KAN.—J. W. Niihaus, County Clk., writes us that the contract for six county bridges, recently noted, has been awarded to O. C. Chapin, Springdale, Kan., at $1,200. There were eight bids.

KANSAS CITY, KAN.—The city engineer is preparing plans for the proposed new bridge across the Kaw River at Central Ave.

ST. LOUIS, MO.—An ordinance has been passed for a new bridge across Mill Creek Valley at 12th St.——A petition has been presented for a bridge over the Des Peres River at Tyler road. Chas. Galler, Supt. Bridges.

ARKANSAS.—A press report of Jan. 15 states that the House bill authorizing the Little Rock and Pacific R. R. Co. to construct bridges across the Fourche la Fave and Petit Jean rivers in Arkansas was passed without amendment.

WACO, TEX.—It is stated that the improvements for 1895 include a steel highway bridge over the Brazos River.

DENVER, COLO.—Residents of Jerome Park have petitioned for a bridge over the Platte River at Third Ave.

WINDSOR, ONT.—The construction of a bridge 32 ft. wide, with one 6-ft. walk, over the Michigan Central tracks at Sandwich St. is reported as soon to be commenced.

## BUILDINGS.

BURLINGTON, VT.—Plans have been made by Walter Dixon, Bible House, New York, for a $75,000 store and flat building, for A. E. Richardson.

WATERBURY, VT.—Bids are asked until Feb. 14 for the enlargement of the state insane asylum at this place. Gov. U. A. Woodbury, Burlington, is one of the trustees.

JAMESTOWN, N. Y.—The council is reported about to direct the board of public works to prepare plans for the erection of a city building to cost from $50,000 to $75,000.

NEW YORK, N. Y.—A site has been purchased by Oscar Hammerstein for a new theatre and music hall, which will probably cost $500,000. The plot is on Broadway, between 44th and 45th St.——John Pettit, 93 Nassau St., has filed plans for a seven-story brick office building to cost $100,000.——J. T. Williams, 871 Madison Ave., has filed plans for a ten-story brick warehouse to cost $350,000.

PORT RICHMOND, N. Y.—It is stated that plans have been practically approved by the Baltimore & Ohio and the Staten Island Rapid Transit companies for a large ferry and station building at St. George, S. I. Archs., Baldwin & Pennington, Baltimore.

PHILADELPHIA, PA.—Plans are nearly completed for a large building to be erected by John Wanamaker, at the northwest corner of 12th and Chestnut Sts.

BALTIMORE, MD.—Bids are asked until Jan. 28 for work required for the new city college building. Archs., Baldwin & Pennington.

BALTIMORE, MD.—Plans for a $90,000 hotel are being made by W. D. McLaughlin, 1318 East Baltimore St.

NEW BERNE, N. C.—Bids are asked until Feb. 14 for the excavation, concrete foundations, stone and brick work, iron and wood floor, ceiling and roof construction, etc., for the U. S. public building in this city, as stated in our advertising columns. Address Chas. E. Kemper, Acting Supervising Architect, Washington, D. C.

ALABAMA CITY, ALA.—It is reported that the Dwight Mfg. Co., of Chicopee, Mass., has awarded contracts for a $600,000 cotton mill and 150 tenement houses at this place, a manufacturing suburb of Gadsden, Ala.

CHATTANOOGA, TENN.—Competitive plans will be received until Jan. 21, according to reports, for a $60,000 city hall. The lot is 60 × 384 ft. G. W. Ochs, Mayor.

MANSFIELD, O.—Bids are asked until Feb. 6 for the iron work to complete the west wing of the reformatory, such as cell doors, lock bars, locks, bunks, stairs and balconies; also plumbing, water tanks, steam fitting and ventilating apparatus. Arch., L. T. Scofield, Case Block, Cleveland. E. H. Kelger, Chn. Com.

BRAZIL, IND.—The commissioners of this (Clay) county have authorized an issue of $20,000 in bonds for a new jail.

ANNA, ILL.—Press reports state that plans have been prepared for rebuilding the hospital building, noted last week as burned, and that Dr. W. C. Lence, Supt., has gone to Springfield, to secure an appropriation of $200,000 to construct the new buildings.

CHICAGO, ILL.—Plans for a $250,000 warehouse for the Sibley Warehouse & Storage Co. have been made by Jarvis Hunt, 1407 The Monadnock.

SPARTA, WIS.—The building committee has agreed upon plans for a $50,000 courthouse and it is stated that the construction will be commenced at once.

DES MOINES, IA.—The contract for the iron work for the new Turner building, to be six stories high, has been awarded to Crellin & Lovel', Des Moines.

KANSAS CITY, MO.—It is reported that plans are being made to add six stories to the Keith and Perry Bldg., at Ninth and Walnut Sts., at a cost of $450,000.

DECATUR, TEX.—The court house at this place was burned Jan. 8.

WACO, TEX.—Press reports state that the improvements for 1895 will include a $100,000 court house and a $40,000 high school building.

SALT LAKE CITY, UTAH.—The "Tribune" states that the Salt Lake & Los Angeles Ry. Co., which has used the depot of the Rio Grande Western during the two years of its existence, has plans about completed for the erection of a depot building, at the corner of First South and Fourth West Sts., which will be built at an early date.

## WATER-WORKS.

BANGOR, ME.—M. M. Tidd, of Boston, has made plans for a power house and water tower and reservoir, which it is stated are much needed.

BRIDGTON, ME.—The Bridgton Water & Electric Light Co. has been incorporated by Wm. A. Stevens, A. H. Walker, Frank E. Stevens, Abel H. Harriman and Wm. W. Mason; capital stock, $50,000.

DEXTER, ME.—The Dexter Water Co. has petitioned for a charter.

CHESTER, N. H.—The Chester Water-Works Co. has petitioned for a charter.

PETERBORO, N. H.—The citizens have petitioned for authority to put in works.

LYDONVILLE, VT.—At the annual meeting, Jan. 9, it was voted to issue $40,000 in bonds for works. O. G. Chase, A. D. Paige and George Shorey, Comrs.

MILLER'S FALLS, MASS.—J. A. Taggart, Chn. Com., writes us that the legislature has been petitioned for an act of incorporation to put in works estimated to cost about $20,000; proposed supply from the Turner's Falls water-works; Engr., Percy M. Blake, Hyde Park.

NEW BEDFORD, MASS.—It is hoped to commence work on the proposed additional supply this spring. Engrs., Rice & Evans.

NORTON, MASS.—The town is reported about to apply for authority to put in works.

ALFRED, N. Y.—D. B. Stillman, Village Clk., writes us that there is no probability of the immediate construction of works, as there is no known source for a desirable domestic supply or for gravity works. The only action likely to be taken will be the construction of some supply cisterns for a small fire engine, owned by the village.

BROOKLYN, N. Y.—The aldermen have authorized an issue of $1,250,000 in bonds for new conduits and mains.

BUFFALO, N. Y.—The commissioners of public works have under consideration the advisability of recommending to the council that a new intake crib be built. The present capacity of the water supply is gradually becoming inadequate to meet the demand. Chairman Gatchell says, however, that such a recommendation will not be made right away. Maj. E. H. Ruffner, U. S. Engineer, has been requested by the board to furnish it with figures on the soundings in the lake and river opposite the city.

CANANDAIGUA, N. Y.—Charles F. Robertson, Pres. Bd. Comrs., writes us that a complete system with about 22 miles of pipe is contemplated, but that the plans have not yet been completed. The supply will be pumped from a lake to a 3,000,000-gallon reservoir; estimated cost, $100,000; Engr., Walter F. Randall.

CANASERAGA, N. Y.—F. O. Jones, Village Clk., writes us as follows: The village has not as yet signed any contract for water-works. The company which has the permit is at present represented here by S. E. Halpin, who is still engaged in canvassing. If a plant is put in, which is quite probable, it will be on the gravity system and supplied by springs; population, 800.

CENTRAL VALLEY, N. Y.—The town is reported as being canvassed for works.

CHARLOTTE, N. Y.—D. R. Warner, Clk., writes us that no steps have been taken looking toward a water supply, although the matter is being agitated.

MORRIS, N. Y.—J. Warren Lamb, Cooperstown, writes us that materials for works have been awarded as follows: Cast iron pipe to the Jackson & Woodin Mfg. Co.; hydrants to R. D. Wood & Co.; valves and boxes to Charles Millar & Sons (Eddy valves).

FORESTVILLE, N. Y.—W. H. Parsons, Clk., writes us as follows: We are practically at a standstill, awaiting certain decisions. Nothing will be done before spring at least.

FORT PLAIN, N. Y.—Bids are asked until Feb. 5 for the construction of works, including furnishing and laying 1,203 tons of 10 to 4-in. pipe, 57 hydrants, reservoirs, etc., as stated in our advertising columns. Harvey Wick, Secy. Comrs.

LE ROY, N. Y.—An election will be held Jan. 29 to vote on an appropriation of $1,500 to sink other test wells and make additional experiments in search of a water supply for domestic purposes.

MONTGOMERY, N. Y.—W. L. McKinney, Cy. Clk., writes us there will be an election called soon to vote on an issue of $18,000 in bonds for works.

STAMFORD, N. Y.—J. G. Dean, Clk., writes us that an application for a franchise has not yet been acted upon by the trustees, but will probably be granted soon to a local company.

WAPPINGER'S FALLS, N. Y.—The village clerk writes us that the president has been authorized to employ an engineer, but that no vote has yet been taken on the question. Address James S. Roy.

BOONTON, N. J.—A tunnel for the Boonton Water Co. is being constructed by Chas. A. Rooney.

HIGHTSTOWN, N. J.—A. S. Voorhees, Secy. Com., writes us that the council has recommended a bond issue of $20,000 for works, $10,000 for electric lights and $10,000 for sewers, and that a petition is being circulated to call an election to vote on the question. The citizens seem much in favor of the improvements.

BEAVER FALLS, PA.—Bids are asked until Feb. 5 for furnishing materials and constructing works, including a filter plant, as stated in our advertising columns. Engrs., J. H. Harlow & Co., Pittsburg; W. W. Kerr, Secy. Council.——At an election Jan. 5 the citizens voted, 1,351 to 42, in favor of an issue of $125,000 in bonds for new works. The contracts for this work were awarded some time ago, but the previous election was declared illegal.

MINERSVILLE, PA.—The Minersville Water Co. is reported about to build a large reservoir on Big Creek.

CANONSBURG, PA.—The Canonsburg Water Co. will commence the construction of works in the spring.

EASTON, PA.—The proposition to issue $250,000 in bonds to purchase or construct works is reported to have been defeated in select council.

FRANKLIN, PA.—A special committee is investigating the question of new works to be owned by the city. About 14 miles of pipe would be required, and two reservoirs, estimated cost, $100,000; T. L. Kennerdell, Cy. Engr.

PHILADELPHIA, PA.—An ordinance has been introduced in the council providing for the erection of a 20,000,000-gallon filter plant at the Roxborough reservoir; estimated cost, $210,000.

PITTSBURG, PA.—The finance committee of councils has recommended the purchase of four lots adjoining Highland Park, for $4,800, for reservoir purposes.

QUAKERTOWN, PA.—S. A. Krauss, Secy. Council, writes us that the council has not yet passed an ordinance for the construction of works.

WILKES BARRE, PA.—The Wilkes Barre Water Co. has signed a contract with the Morrison-Jewell Filtration Co., New York, for a plant to filter 8,000,000 gallons of water a day, the plant to be completed by May 1.

WILKESBARRE, PA.—The Citizens' Water Co. has petitioned for a franchise. Weeks & Rutter, of this city, have made a preliminary survey for a supply from the Lehigh River, 26 miles distant, and at an elevation of 1,200 ft. above this city. The proposed work is estimated to cost $400,000, and it is hoped to begin the construction in the spring. Pres., A. W. Jackson; Secy., D. O. McCollum.

WRIGHTSVILLE, PA.—S. S. Detweiler, of Columbia, and N. C. Freech, of Millersburg, are reported to have made a proposition to put in works; proposed supply from springs on the farm of Mr. Detweiler on the hills above the town. The borough is asked to pay $20 per year each for about 24 fire hydrants.

WAYNESVILLE, N. C.—C. H. Ray, Mayor, writes us that an election will be held May 6 to vote on the construction of works, estimated to cost about $15,000. No engineer has yet been employed.

CUTHBERT, GA.—Robert L. Moye, Mayor, writes us that it was intended to award contracts for works next month, but that unexpected delays have been encountered, and it is not known when the contracts will be awarded.

THOMASVILLE, GA.—There is talk of constructing works, according to reports.

SAN ANTONIO, FLA.—J. Francis LeBaron, Jacksonville, has prepared plans and estimates for works for domestic and irrigation purposes for the town of San Antonio de Padua, a Catholic colony in this state.

LAKE CITY, FLA.—Bids are being received by the Lake City Water & Light Co., according to reports, for 30 tons of 4-in. cast iron pipe.

CANTON, MISS.—Bids are asked until Feb. 6 for constructing works. H. W. Latimer, Cy. Clk.

CASCADE, LA.—The contract for a steel tank, to be erected on a steel tower for the new works, has been awarded to Creilin & Lovell, Des Moines.

CROWLEY, LA.—Bids are asked until Feb. 4 for constructing a water-works and electric light plant. The works will include two miles of 10 to 6-in. mains, 19 hydrants and a water tower 96 ft. high, with a 15 × 32-ft. steel tank. P. J. Chappuis, Mayor.

CARROLLTON, KY.—Bids are asked until Jan. 24 for the construction of works, for which $20,000 in bonds was recently voted. O. M. Wood, Mayor.

MOUNT STERLING, KY.—This city is reported to have completed arrangements with John P. Martin, of Xenia, O., for the construction of works and an electric light plant.

COLUMBIANA, O.—Press reports state that bids have been asked for the purchase of water and electric light bonds. E. L. Roninger, Cy. Clk.

INDIANAPOLIS, IND. The Indianapolis Water Co. has engaged Lewis K. Davis, of New York, as consulting engineer in the design of a new 20,000,000-gallon triple-expansion pumping engine for the company's upper pumping station.

MADISON, IND.—The bids for the pumping engine have been rejected, and it is reported that new bids will soon be asked for. The two bids received were noted last week under Contract Prices.

CHESANING, MICH.—J. B. Morehouse, Village Clk., writes us that test wells are now being sunk, and that as soon as the location of the pump house is determined, specifications will be sent out for bids.

DETROIT, MICH.—There were 15 bids received for the $100,000 of 4½ 30-year bonds, and that of E. H. Rollins & Son, of Boston, at $111,100, was accepted.

DECATUR, MICH.—Bids are asked until Jan. 23 for the construction of works. The contract noted last week as awarded to Mann & Andrews, of Dowagiac, was for the sinking of wells for the supply. Frank C. Stapleton, Cy. Clk.

BELLEVILLE, ILL.—Extensions and improvements are to be made this year. Consult Engr., John A. Cole, Old Colony Bldg., Chicago.

BROOKLYN, ILL.—The village has granted a franchise to the American Water-Works & Guarantee Co., Pittsburg, Pa. The village agrees to pay $70 per year for six fire hydrants. The supply will be taken from the company's plant at East St. Louis.

CARBONDALE, ILL.—Simeon Walker writes us that the council has been talking water-works for some time, and will consider propositions. No definite action has yet been taken.

DUQUOIN, ILL.—F. E. Nettleton, Cy. Clk., writes us that nothing has yet been done in regard to plans for works.

ELGIN, ILL.—The water department is reported as considering bids for a new 6,000,000-gallon pumping engine.

KNOXVILLE, ILL.—The council has voted in favor of appropriating $15,000 for works; proposed supply from a well 800 or 900 ft. deep.

MAYWOOD, ILL.—We are informed that plans and specifications for complete works are being prepared by Hill & Enright, Engrs., Chamber of Commerce Bldg., Chicago. There will be 28 miles of 12 to 6-in. mains and a 16 × 100-ft. stand-pipe.

LANCASTER, WIS.—John G. Clark, Chn. Com., writes us that the citizens are almost unanimously in favor of works, and that a committee is at work securing estimates, etc. Nothing else will probably be done until summer.

SPARTA, WIS.—Preliminary surveys have been completed for the new works, for which $25,000 has been voted.

DUNLAP, IA.—Bids are asked until Feb. 4 for the purchase of $4,200 in water bonds, and until Feb. 11 for stand-pipe and materials for works. Engr., F. L. Burrell, Fremont, Neb. Thos. Roche, Recdr.

ROCK RAPIDS, IA.—The plant of the Rock Rapids Water Co. has been sold to Joel W. Hopkins, of Granville, Ill., who is reported about to add an electric light plant if a franchise can be secured.

FONDA, IA.—M. G. Coleman, Recdr., writes us that specifications for works will be ready in a few days; $6,000 of 6% bonds will be issued in March. Engrs., Crellen & Lovell, Des Moines. R. F. Beswick, Chn. Com.

OTTUMWA, IA.—The Ottumwa Artesian Well Co. has filed an amendment to its articles of incorporation providing for an issue of stock. Pres., Samuel Mahon; Secy., J. W. Garner.

SIOUX CITY, IA.—The committe has recommended that meters be purchased by the council, and placed generally throughout the city.

STURGIS, S. DAK.—The water company has contracted to furnish a supply at Fort Meade, according to reports, and it is stated that the works will soon be extended to that place.

FULTON, MO.—Elmer C. Henderson, Cy. Clk., writes us that a contract has been awarded for digging an additional well 500 ft. deep. The only machinery needed will be an additional pump, which will be purchased at some time in the future. Supt., Chas. MacDonald.

RICHMOND, MO.—The council is reported to have accepted a proposition of J. H. Christopher to put in works, the contract to be voted upon by the people at an election Jan. 28.

ST. LOUIS, MO.—The commissioners have submitted an ordinance for an extension of the Blair Ave. 36-in. water main, at an estimated cost of $45,000.

WAVERLY, MO.—The city clerk writes us that the water-works proposition failed to carry.

HELENA, MONT.—The only bid received for furnishing this city with water was that of the Helena Consolidated Water Co., at $90 each per year for the 265 hydrants now located, and $60 per year for each additional hydrant; no extensions less than a 6-in. main; fire pressure of 60 lbs.; contract for 10 years. The council rejected this bid and unanimously voted to take steps to submit the question of bonding the city for municipal works and an electric light plant to a vote of the taxpayers

ENNIS, TEX.—J. S. Thatcher, Dallas, has completed surveys and specifications for a new impounding reservoir at this place. The work will include an earth dam across Mustang Creek, 917 ft. long and 34 ft high in the center, and the reservoir will have a capacity of about 175,000,000 gallons.

HEMPSTEAD, TEX.—The franchise granted the Hempstead Water Co. a few months ago has been withdrawn for non-compliance of conditions by the company.

LOCKHART, TEX.—The council is reported as considering two propositions for the construction of works, one of which will probably be adopted and the construction soon commenced.

OAK CLIFF, TEX.—The new stand-pipe is completed, and we are informed that pipelaying will be finished about Feb. 15. Engr., J. S. Thatcher, Dallas.

ALVA, OKLA.—F. M. Cowgill, Cy. Clk., writes us that $25,000 in bonds has been voted to put in works, but that the bonds will have to be legalized by Congress before anything further can be done.

ASTORIA, ORE.—The city received five bids for the purchase of the $200,000 of water bonds, and 29 bids for the construction of works, according to a press report.

LOS ANGELES, CAL.—The Sunny Slope Water Co. has been incorporated to operate in the San Gabriel Valley; capital stock, $140,000; incorporators, J. M. Elliott, Alhambra, Cal.; Albert Stephens and Gervain Purcell, Los Angeles, Cal., and others

COLLINGWOOD, ONT.—We are informed that the extensions proposed at present will consist only of the laying of a few hundred feet of mains. Supt., T. Bassett.

## IRRIGATION.

BOTTINEAU, N. DAK.—V. B. Noble and Henry C. Dana have petitioned the county commissioners to establish two irrigation districts, the first to be known as District No. 1, 760 acres, and the latter to be known as Oak Creek Irrigation district, containing 312 acres.

PHOENIX, ARIZ.—The entire property of the Gila Bend Irrigation & Reservoir Co. and its successor, the Peoria Canal Co., and the Arizona Construction Co., a kindred association, has been purchased at receiver's sale by C. E. Crowley, Los Angeles, Cal. Mr. Crowley is president of the new company, which has been incorporated to operate the canal.

PENDLETON, ORE.—The "Tribune" states that work will soon be commenced on a ditch four or five miles in length to take water from the Umatilla River near Foster; estimated cost, $3,000. Mell Kolb is interested.

NEW COMPANIES.—Laurel Hill Ditch Co., Oregon City, Ore.; $1,000; O. M. Knox, J. B. Lindsay, J. D. Hyde and others.

Jackson Investment Co., San Diego, Cal.; $300,000, all paid in; to build irrigation and water systems, etc.; Jas. W. Jackson, Mary Jackson, C. B. Richards.

Sandy Irrigation Co., Sandy, Utah; $16,650; to operate about four miles of ditches already built; Pres., W. W. Wilson; Secy., Emil Hartoicksen.

Farmers' Mutual Irrigation Co., Kearney, Neb.; $10,000, commencing with $2,000; E. J. Hubbell, J. E. Decker, G. N. Smith, A. Wareham, J. F. Palst, B. H. Andrews, Asa Thompson, G. Fleharty, H. N. Fox.

## SEWERAGE.

BENNINGTON, VT.—Bids are asked until Jan. 26 for the purchase of $31,000 of 4% sewer bonds. These bonds are sold for sewers built last year. J. S. Holden, J. T. Shurtleff and G. R. Mathers, Com.

BOSTON, MASS.—It is proposed to make a loan of $300,000 to $400,000 for additional sewage pumping facilities at the Cow Pasture and Moon Island. The superintendent recommends for the Cow Pasture plant two wheel pumps, like those used for pumping sand at the Calumet & Hecla mines, in preference to one 60,000,000-gallon high-speed triple-expansion pumping engine.

FITCHBURG, MASS.—The construction of a trunk sewer through this city, at an estimated cost of $250,000, is being discussed.

SOUTHINGTON, CONN.—Surveys have been prepared by F. H. McKenzie for sewers, estimated to cost $40,000.

BROOKLYN, N. Y.—Bids are asked until Jan. 21 for constructing sewer basins during the year. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—The board of public works opened the following bids Jan. 8, for the construction of a sewer in Broadway, from Ideal St. to 730 ft. west of the city line: John Mumm, $6,776; Elmer Mighton, $4,889; W. A. Rappich, $5,846; W. C. Smith, $4,644; Chris. Smith, $4,160; Henry Harter, $5,234; Henry Kibben, $5,902; Fred J. Martin, $6,987; George W. Moore, $5,318; August Gisel, $6,066; Jacob Ritzmann, $6,150; John Harrer, $4,900. All the bidders are Buffalo men.

HIGHTSTOWN, N. J.—A. S. Voorhees, Secy. Com., writes us that a petition is being circulated to secure signatures for an election to vote on the issue of $10,000 in bonds for sewers.

HOBOKEN, N. J.—An ordinance has been passed by the council for the construction of a sewer to drain the meadow district with an outlet into the Hudson River.

PATERSON, N. J.—The committee has voted to recommend the construction of sewers in 10 streets.

PITTSTON, PA.—Lindsay & Van Loon, Plymouth, have been awarded a contract for a sewer in Main St., at $9,710.

SCRANTON, PA.—J. P. Phillips, Cy. Engr., has prepared plans for constructing a sewer in three wards, at an estimated cost of $36,000.

YORK, PA.—It is proposed to construct sewers in three streets at a cost of $13,400.—An ordinance has been introduced authorizing a loan of $2,500 for plans for a complete system.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Feb. 4 for constructing sewers, as stated in our advertising columns.

CHARLOTTESVILLE, VA.—Work on the sewerage system is progressing rapidly. About 11 miles of pipe have been laid, 20 flush tanks and 170 manholes constructed, and about nine miles of pipe remains to be laid. Engr., N. Wilson Davis.

ATLANTA, GA.—The committee has asked for an appropriation of $100,000 for sewer work during the year. It is proposed to build the Connolly St. sewer as soon as the appropriation is made.

MEMPHIS, TENN.—The extension of the system in South Memphis is being considered. James H. Ellicott, Engr., is preparing a report.

COLUMBUS, O.—Bids are asked until Jan. 22 for furnishing 2,700 ft. of 15 and 12-in. sewer pipe, 50 iron catch basin covers, 200 bbls. cement and other sewer supplies during the year. J. P. Bliss, Dir. Pub. Impvts.

IRONTON, O.—Geo. H. Davies, Cy. Clk., writes us that injunction proceedings have stopped the sewer work recently noted.

INDIANAPOLIS, IND.—It is reported that a large amount of sewer work is projected for this year. Chas. C. Brown is city engineer.

GROSSDALE, ILL.—Hill & Enricht, Chicago, have been engaged to have charge of the building of about 30 miles of sewers.

LA GRANGE, ILL.—We are informed that about four miles or sewers are to be constructed during the coming season.

MAYWOOD, ILL.—About one mile of main and two miles of lateral sewers are to be constructed during this year.

STERLING, ILL.—The aldermen have adopted resolutions for the construction of the West Broadway sewer system, estimated to cost $19,991. J. F. Utley, S. S. Hynes and John Mee are on the committee.

BURLINGTON, IA.—Plans have been completed by the city engineer for the rebuilding of the Valley St. sewer from Fifth St. to the river in a single channel, a distance of 1,436 ft., estimated to cost $35,000 to $40,000.

IOWA CITY, IA.—C. S. Magowan, Cy. Engr., has submitted a report for the proposed extension of the system for a length of 20,000 to 25,000 ft.; estimated cost of storm sewer, $3 per lin. ft.; 16 to 18-in. pipe sewer, 75 cts. per lin. ft.; 8 to 10-in. pipe sewer, 40 to 50 cts. per lin. ft.; manholes, $30 each; flush tanks, $70 each.

ST. LOUIS, MO.—Bids are asked by the board of public improvements until Feb. 5 for constructing a sewer in Clarendon Ave.—Ordinances have been approved for constructing five district sewers.—It is proposed to appropriate $5,900 for maps of topographical surveys.

## GARBAGE DISPOSAL.

WOONSOCKET, R. I.—The mayor has recommended in his message that the question of garbage disposal be investigated by the council.

BRIDGEPORT, CONN.—The American Garbage Cremator Co., Boston, has submitted a proposition to put in a plant to cost about $15,000.

BINGHAMTON, N. Y.—The health committee of the common council has suggested that the only satisfactory way out of the present garbage difficulty is the erection of a crematory to burn garbage. It is reported probable that the question of constructing a crematory will soon be submitted to a vote of the people.

JAMESTOWN, N. Y.—The board of health has passed a resolution to prevent the burying of garbage within the limits of the corporation. It is stated that the garbage will probably be disposed of in the old way, by burying, but outside the corporation limits.

CAMDEN, N. J.—L. E. Farnham, Cy. Engr., writes us that the following bids were received Jan. 9 for the erection of a 60-ton garbage furnace in this city; city provides the land and bids are made on furnace, stack and foundations (pile) in one bid, and covering building (frame of wood and covered with corrugated iron) incline, coal shed or 10,000-gallon oil tank, covered; the building to be placed on pile foundation:

National Furnace Co., Philadelphia; Lance patent; none built on this patent but used in brick kilns; consists of six three-ton furnaces in a circle with stack in the center and gas producer; fuel used being oil converted into gas; checker chambers between each small furnace; natural draft through one or all the furnaces, continuous operation;

| | |
|---|---|
| Crematory and building, tank and driveway | $8,150 |
| Crematory, stack and foundations | 6,747 |
| Building, driveway, tank | 2,698 |

Monarch Light & Heat Co., Philadelphia; small coil furnace, English pattern, using oil sprayed with steam;

| | |
|---|---|
| Furnaces, etc. | $6,450 |
| Building, etc. | 2,400 |

American Garbage Cremator Co., Boston, Mass.; Brown patent; single cell furnace using oil injected with steam and air; guaranteed to burn garbage for 40 cts. per ton;

| | |
|---|---|
| Crematory and buildings | $13,000 |
| " " all iron building | 14,000 |
| Double furnace and iron building | 15,000 |

Engle Sanitary & Cremation Co., New York; would use a new pattern, recently patented, single cell, double grate, upper one being the drier, fuel used being oil injected by compressed air with boiler in stack to furnish steam for blower pump and fan; lower grate being divided by wall; auxiliary jets may be used in end above the upper grate or in bridge wall on lower grate, stack end;

| | |
|---|---|
| Crematory, stack, boiler, engine, fan and pump | $8,333 |
| Buildings, etc. | 3,113 |
| Coal burning furnace, similar type: | |
| Crematory, etc. | $6,946 |
| Buildings, etc. | 5,000 |

M. V. Smith Furnace; two cylindrical cells with two checker chambers between and gas producer using coal

in adjacent chamber; an adaptation of the Siemens-Martin furnace;

Crematory, etc. ..... $9,970
Buildings, etc. ..... 4,150

Rider Garbage Co., Pittsburg, Pa., single cell, rectangular, using coal; natural draft:

Crematory, etc. ..... $12,500

Dixon Furnace, Findlay, O.; rectangular cell with two coal fires, one above and one below, in the front and a small fire in the base of the stack to burn escaping odors, stack lined with firebrick to top; claimed to be an infringement by the Engle company of its patents;

Crematory, etc. ..... $3,700
Building without paved floor or coal shed..... 1,295

F. L. Clark, Philadelphia; utilization plan; steam disintegration with the removal of grease, drying and grinding and the tankage; would make a ten-year contract with the city, taking the vegetable garbage delivered free in tank and guarantee no odors would escape, for the sum of $23,000 at the end of the term, provided the city wished to purchase. No expense to the city for treating the garbage, but contractor to become the owner of the products.

The appropriation for the crematory was $10,000; furnace to cremate 60 tons in 24 hours; time for building being two months, and each furnace with stack and foundations to be complete in working order; building, driveway, etc., may be built later under an additional appropriation; award will be made on Jan. 29.

WILMINGTON, DEL.—The following bids have been received for collecting garbage during 1895:

| | Districts No. 1. | 2. | 3. | 4. |
|---|---|---|---|---|
| Chas. H. Colburne..... | $1,850* | .... | .... | .... |
| F. Fitzgerald ..... | 1,850 | $2,560 | $2,560 | $4,578 |
| Lelion Collins..... | .... | 2,600* | .... | .... |
| Alfred Harmann..... | .... | 2,550 | .... | .... |
| D. P. Hamilton..... | .... | 2,548 | 2,532 | .... |
| Edward Congo..... | .... | .... | 3,050 | .... |
| W. J. Winchester..... | .... | .... | 2,525 | .... |
| Thos. Fagan..... | .... | .... | 2,600* | 4,585* |
| A. G. B. Anderson**..... | .... | .... | 3,000 | 4,150 |
| Thos. Roney..... | .... | .... | .... | 4,150 |

* Awarded contract. ** For the entire city, $11,500.

PHILADELPHIA, PA.—A permit has been granted Keen & Frazier, of Cramer Hill, N. J., to construct a two-story brick and stone garbage incinerating plant, 83 x 163 ft., at the corner of Morris St. and Schuylkill Ave., for the American Incinerating Co.

## STREETS AND ROADS.

EAST BERLIN, CONN.—Geo. H. Sage has been awarded a contract to macadamize a portion of highway, at $7,500.——The issue of $50,000 in bonds for macadamizing the highways of the town is being discussed.

JERSEY CITY, N. J.—Bids are asked until Jan. 17 for the purchase of $600,000 of 4½% Hudson county road bonds. John Boyd, Clk.

PATERSON, N. J.—It is reported that Midland township has voted to issue $30,000 in bonds for macadamizing the roads.

ALLEGHENY, PA.—The question of paving Perryville Ave., estimated to cost $325,000, it being discussed.

PITTSTON, PA.—The Barber Asphalt Paving Co. has been awarded a contract for paving a portion of Main St., at $23,630.

WASHINGTON, D. C.—G. C. Esher, Allison Nailor and Ernest Dahle, of the North Capitol Improvement Association, have petitioned the district commissioners for the improvement of six streets.

AVONDALE, O.—Bids are asked until Feb. 7 for the improvement of Rockdale Ave. W. E. Wynne, Corporation Clk.

EAST ST. LOUIS, ILL.—Alex. E. Abend, Cy. Engr., writes us that he is preparing estimates for improving five streets, which will cost over $250,000.

GROSSDALE, ILL.—We are informed that about 30 miles of streets are to be macadamized during the coming year and a considerable amount of sidewalks and stone curbs will be set.

WAUKEGAN, ILL.—Specifications have been prepared for paving a street 54 ft. in width with brick.

OTTAWA, ONT.—Bids are asked until Feb. 20 for paving Sparks and Bank Sts. with asphalt. Robert Surtees, Cy. Engr.

## MISCELLANEOUS CONTRACTS AND SUPPLIES.

BOOMS.—Ottawa, Ont.—Bids are asked until Jan. 19 for the construction of 4,000 lin. ft. of four-log boom. J. H. Balderson, Secy., Dept. Rys.

PIER WORK.—New York, N. Y.—Bids are asked by the department of docks until Jan. 31 for repairing the pier at the foot of West 55th St., North River.

FREIGHT CARS.—St. Louis, Mo.—The Missouri, Kansas & Texas Ry. Co. is reported as receiving bids for 800 box cars, 500 coal cars, and 700 furniture cars.

CONDUITS.—Baltimore, Md.—The subway commission is reported as soon to ask for bids for 100,000 to 150,000 ft. of additional conduits, to cost about $100,000.

TELEPHONE PLANT.—Oconto, Wis.—It is reported that a new telephone plant will be put in if a five-year franchise can be secured, the rental to be $2 per month for business houses.

LIGHT STATION.—Portland, Ore.—Bids are asked until Feb. 20 for the metal work for the Coquilville River light station, Ore., as stated in our advertising columns. Maj. Jas. C. Post, U. S. Lighthouse Engr.

DOCK WORK.—Ashland, Wis.—The contract for raising the Chicago & Northwestern railway docks at this place is reported to have been awarded to Balch & Peppard, of Minneapolis, the work to be completed by May 1.

DREDGING.—Philadelphia, Pa.—Bids are asked until Feb. 4 for dredging docks not belonging to the city and in front of the bulkheads not belonging to the city where city sewers empty. Joel Cook, Pres. Bd. Port Wardens.

TELEPHONE FRANCHISE.—Berlin, Wis.—The council has granted a franchise to the Badger Telephone Co.

CONCENTRATOR.—Salt Lake City, Utah.—The Ajax Mining Co. is reported as receiving bids for a 100-ton concentrator.

HEATING AND VENTILATING APPARATUS.—St. Albans, Vt.—Bids are asked until Feb. 6 for the steam heating and ventilating apparatus for the U. S. public building in this city, as stated in our advertising columns. Address Chas. E. Kemper, Acting Supervising Architect, Washington, D. C.

BONDS.—Pittsburg, Pa.—The councils have passed an ordinance providing for a popular vote on bond issues amounting to $4,750,000. The money is to be used in the erection of a building for the department of public safety, for the improvement of the waterworks and parks, for the construction of a boulevard from the heart of the city to the East End and the purchase of sites for engine houses.

BARRACKS.—San Francisco, Cal.—Press reports state that plans are being prepared under the direction of the department quartermaster for the reconstruction of the Presidio barracks, and the general improvement of the reservation, at an estimated cost of $1,000,000. The plans will be forwarded to the quartermaster-general in Washington for indorsement by the War Department, after which Congress will be asked to make the necessary appropriation.

DRY DOCK.—Newport, R. I.—A press report states that T. P. Crowley has leased from Commodore F. P. Sands his shipyard property, recently purchased by him, for 10 years, and intends to make a specialty of yacht repairing. He is to build a dry dock and marine railway large enough to take the largest vessel of the New York Yacht Club fleet, and will dredge to a depth of 30 ft. off the yard. Yacht owners have in the past been obliged to go to Boston or Providence to haul out.

DEEP WATER.—Victoria, Tex.—A press report from this place Jan. 7, states as follows: An enterprise has been quietly forming here during the past two or three weeks, having in view the deepening of water over Pass Caballo bar, and the building of a seaport at Alligator Head. The statement has been made that work will commence in a short time, but the authority for the statement does not appear at present. However, it is known that the men connected with the scheme have plenty of capital and can carry it through if they choose.

## CONTRACT PRICES.

CAST IRON PIPE.—Cleveland, O.—The following bids were received Jan. 10 for furnishing cast iron water pipe and specials for the year 1895; the prices being per ton of 2,000 lbs.; Supt., A. H. McAlpine:

| Bidder. | Pipe, per ton— 4-in. | 6-in. | 8-in. | Specs. |
|---|---|---|---|---|
| Lake Shore Foundry*..... | $24.75 | $23.75 | $23.75 | $55.00 |
| Addyston Pipe & Steel Co.* | 23.97 | 23.75 | 23.75 | 55.00 |
| Ohio Pipe Co.**..... | 20.00 | 19.60 | 19.50 | 42.50 |
| Anniston Pipe & Fdry. Co.*** | 19.65 | 19.65 | 19.65 | 42.50 |

* Delivered on street. ** Delivered on street 50 cts. per ton extra. *** F. o. b. cars Columbus.

WALKS AND GRADING.—Denver, Colo.—The board of public works has awarded the following contracts for street work for the coming year: Wooden crosswalks and sidewalks, James R. Connelly, at 19 cts. per ft. for a 4-ft. walk, 20.4 cts. for 6-ft., 30 cts. for 8-ft., 41 cts. for 10-ft. 50 cts. for 12-ft., 64 cts. for 16-ft. and 60 cts. for 20-ft. Artificial stone walks, A. Stutzer & Co., at 16 cts. Walks of Colorado sandstone and of Indiana and Ohio stone, Hugh Murphy, at 17, 21 and 25 cts. per lin. ft. for 4, 6 and 8-ft. walks of Colorado sandstone, and 26 and 33 cts. for 3 and 4-ft. walks of Indiana or Ohio stone. Walks of Kansas stone, A. B. Cole, at 19½ and 25 cts. for 3 and 4-ft. walks. P. H. Mahoney obtained the contract for grading 26th St., from Hickory St. to tax lot 8, at 10 cts., and Henry Hall the contract for grading 33d St., from Dodge to Davenport Sts., at 7.78 cts. per cu. yd.

STREET REPAIRS, ETC.—Philadelphia, Pa.—The following contracts for repairing pavements during 1895 have been awarded: For repairing paved streets, to the Mack Paving Co., Thomas Cunningham, P. McManus, George A. Vare, William J. McNichol and David McMahon, at prices ranging from 22 cts. to 24½ cts. a sq. yd. The brick paving was awarded to the Mack Paving Co., at from 65 to 95 cts. per sq. yd., and the Vulcanite Paving Co. secured the asphalt work, at $2.25 a sq. yd. for renewing wearing surface, and $3.50 per sq. yd. when the foundations must be repaired. The repairs to footways were awarded to Geo. F. Murray, Geo. W. Ruch and Arthur Hanwell, at from 32 cts. per sq. yd. for brick to $1.79 for asphalt. The contract for delivering, furnishing and spreading broken stone was given to Peter O'Hey, at $1.80 per cu. yd. The contract for the planking roadway on 58th St. was awarded to M. & J. B. McHugh, at $14.85 per M. ft. of planking in place.

CEMENT.—Detroit, Mich.—The board of public works received the following bids for the furnishing of 50,000 bbls. of cement, for use in the construction and repairing of sewers and receiving basins; cement to be delivered in sacks, two being equal to a barrel, and the bids containing price per barrel at which the cement is to be furnished, and the price which the bidder would pay the city for the empty bags: Milwaukee Cement Co., 78 cts., 8 cts. for bag, 62 cts. net; Western Cement Co., Louisville, Ky., 83 cts., 10 cts. for bag, 63 cts. net; C. H. Little, Detroit, 74 cts., 5 cts. for bag, 64 cts. net; Cummings Cement Co., Buffalo, 76 cts., 9 cts. for bag, 66 cts. net; Buffalo Cement Co., 79½ cts., 4 cts. for bag, 71½ cts. net. The Milwaukee Cement Co. was awarded the contract.

LEVEE WORK.—Memphis, Tenn.—The following bids were received by Capt. S. W. Roessler, U. S. Engineer Office, for constructing levees in Upper White River Levee District, Dec. 31, (a) being stations 86 and 50 westward as far as funds will permit; (b), station 1392 south as far as funds will permit: Chas. H. Dameron & Co., Lake Prior, La. (a), 83,333 cu. yds., 12 cts. per cu. yd.; (b), 234,483 cu. yds., 14½ cts. McLaughlin Bros., Memphis, (a), 105,374 cu. yds., 9.49 cts.; (b), 266,876 cu. yds., 12.74 cts. Forrest & Co., Memphis, (a), 109,589 cu. yds., 9⅛ cts., lowest;; (b), 194,286 cu. yds., 17½ cts. J. C. Hodge, Griffin, La., (a), 80,000 cu. yds., 12½ cts.; (b), 227,425 cu. yds., 14.95 cts. W. A. Shippey, Friars Point, Miss., (a), 100,200 cu. yds., 9.98 cts.; (b), 261,740 cu. yds., 12.99 cts. Batt O'Brien, Memphis, (a), 85,251 cu. yds., 11.73 cts.; (b), 230,821 cu. yds., 14.73 cts. C. A. Winter, Greenville, Miss., (b), 209,877 cu. yds., 16 1-5 cts. Timothy Sullivan, (a), 105,263 cu. yds., 9½ cts.; (b), 215,873 cu. yds., 15⅝ cts. T. H. Rice, Helena, Ark., (a), 103,092 cu. yds., 9.70 cts.; (b), 226,666 cu. yds., 15 cts. Moore & Welsh, Memphis, (b), 269,307 cu. yds., 12⅝ cts., lowest. T. S. Aderholdt, Friars Point, Miss., (a), 99,206 cu. yds., 10.08 cts.; (b), 247,452 cu. yds., 13.74 cts. Johnsen & Qutzen, Memphis, (a), 81,699 cu. yds., 12.24 cts.; (b), 234,644 cuu. yds., 14.49 cts. J. C. McIntyre & Co., Memphis, (a), 89,445 cu. yds., 11.18 cts.; (b) 228,648 cu. yds., 14.87 cts. McBain & Co., Memphis, (a), 91,954 cu. yds., 10⅞ cts.; (b), 224, 793 cu. yds., 15⅛ cts. W. L. Withers & Co., Memphis, (b), 234,807 cu. yds., 14.48 cts.

STONE.—Nashville, Tenn.—We are informed that the following bids were received by Capt. John Biddle, U. S. Engineer Office, last month for supplying stone for lock No. 5, Cumberland River:

Bids for Furnishing Stone for Lock No. 5 Delivered in Barges in Cumberland River.

| Bidder. | Sills, 93 cu.yds. | Hollow quoins, 98 cu.yds. | Special stones, 200 cu.yds. | Coping, 350 cu.yds. | Pointed faced face, 2,000 cu.yds. | Square faced rubble, 1,320 cu.yds. | Backing, 7,000 cu.yds. | Total. |
|---|---|---|---|---|---|---|---|---|
| James E. Sloan & Co., Nashville, Tenn..... | $35.00 | $27.50 | $15.00 | $20.00 | $8.00 | $5.00 | $4.00 | $66,550 |
| J. A. Doyle & Co., Knoxville, Tenn..... | 15.30 | 21.50 | 15.00 | 14.50 | 11.00 | 4.90 | 3.50 | 64,573 |
| J. S. Hutton & Son, Birmingham, Ala..... | 22.00 | 25.00 | 25.00 | 20.00 | 11.00 | 8.00 | 5.75 | 89,306 |
| Eichel & Arnold, Evansville, Ind..... | 15.54 | 17.16 | 16.89 | 13.65 | 12.84 | 12.30 | 11.40 | 132,998 |
| John Short, St. Charles, Mo..... | 15.20 | 20.80 | 14.20 | 13.75 | 10.15 | 4.00 | 2.20 | 52,084 |
| J. H. Connor, Lebanon, Tenn..... | 12.00 | 16.00 | 12.00 | 12.00 | 9.00 | 4.50 | 3.50 | 57,724 |
| Foster & Creighton, Nashville, Tenn..... | 15.70 | 16.70 | 16.50 | 14.80 | 13.55 | 5.60 | 4.00 | 74,069 |
| Robt. McCarrell & C. E. King, Charleston, S.C. | 16.50 | 23.10 | 14.85 | 14.85 | 11.00 | 4.95 | 3.30 | 63,600 |

BRICK PAVING.—Lima, O.—The itemized bids received for paving the public square with brick were published last week. R. H. Gamble, Cy. Engr., writes us as follows in regard to the action of the council Jan. 7 in awarding the contracts: Motion to adopt report of paving committee awarding material to Coleman & Hallwood, at 56 cts. per sq. yd. was lost, vote 10 to 4; motion to award labor to Currie & Conn, at 27 cts. per sq. yd., lost, vote 10 to 4; motion to award labor to D. B. Emple, at 50 cts. per sq. yd., lost, vote 10 to 4; motion to award both material and labor to T. B. Emple, at his aggregate bid of 1.38 per sq. yd. for Massillon block, stone foundation and Murphy grout filling, was lost, vote 9 to 5; motion to award both material and labor to Coleman & Hallwood at their aggregate bid of $1.60 per sq. yd. for Zanesville-Hallwood block, concrete foundation and sand filling was carried, vote 8 to 4, two not voting. T. B. Emple, of Fort Wayne, Ind., bid on Massillon block, on same foundation and filling, $1.42 per sq. yd., and this block stands an equally good test with the Hallwood block, and is in every way the equal of the Hallwood block, and in some respects its superior. The award is made to the highest, instead of the lowest, as was the case last July and August, and the action will be enjoined, as it was then, and likewise defeated.

CHICAGO DRAINAGE CANAL.—Chicago, Ill.—The following bids were received Jan. 9 for excavating the remaining portion of section F of the drainage canal, the work on which was abandoned some months ago by the original contractors; contract has not yet been awarded:

| | *Glacial drift, cu. yds. | **Rock, cu. yds. | Total. |
|---|---|---|---|
| Halvorsen, Richards & Co.... | $.43 | $.80 | $259,250 |
| E. D. Smith & Co..... | .40 | 1.25 | 249,413 |
| John McAnrow ..... | .33⅜ | 1.00 | 209,550 |
| F. C. Weir ..... | .29½ | .90 | 183,585 |
| John McKickney & Co. ..... | .33½ | .90 | 206,487 |
| Christie & Lowe Const'n Co.. | .35 | 1.00 | 216,707 |
| Griffiths & McDermott..... | .38⅝ | .98 | 237,136 |
| J. W. Byrnes ..... | .37 | .79 | 224,733 |
| Campbell, Dennis & Co..... | .34½ | .74½ | 209,685 |

*572,564 cu. yds. **16,310 cu. yds.

## METAL MARKET PRICES.

LEAD.—New York: 3.1 to 3.12 cts. Chicago, 2.9 cts. St. Louis, 2.9 cts.

NAILS.—Pittsburg: 82 to 85 cts. for wire, and 80 cts. for cut at mill in carload lots.

BARBED WIRE.—Pittsburg: galvanized, $1.85; plain, $1.15 to $1.20, for carloads at mill.

FOUNDRY AND PIG IRON.—New York: $10.00 to $12.50. Pittsburg: $10 to $11. Chicago: $9.50 to $10.50.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.45 to 1.6 cts.; track bolts, 1.8 to 1.9 cts. with square, and 1.9 to 2 cts. with hexagon nuts. Chicago: angle bars, 1.3 to 1.35 cts.; spikes, 1.6 to 1.7 cts.; track bolts, 1.9 to 2 cts., with hexagon nuts.

RAILS.—New York: $22 at eastern mills and $22.75 at tidewater; old rails, $11.50 to $12 for iron, and $10 to $10.50 for steel; steel rails fit for relaying, $14.00; light rails, $20 to $22; girder rails, $24. Pittsburg: $22 for standard sections of 45 lbs. and over; old rails, $12 for iron and $9 to $11 for steel. Chicago, $23 for standard sections; old rails, $10.50 to $10.75 for iron, and $6 to $9 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3

to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.2 to 1.35 cts.; steel plates, 1.25 to 1.4 cts. for tank, 1.4 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.25 to 1.35 cts.; channels, 1.25 to 1.35 cts.; angles, 1.1 to 1.2 cts.; tees, 1.35 to 1.4 cts.; universal mill plates, 1.1 to 1.2 cts.; steel plates, 1.1 to 1.25 cts. for tank, 1.3 to 1.35 cts. for shell, 1.35 to 1.4 cts. for flange, 2.5 to 3.75 for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.45 to 1.5 cts.; channels, 1.45 to 1.5 cts.; angles, 1.3 to 1.35 cts.; tees, 1.5 to 1.6 cts.; universal plates, 1.4 to 1.45 cts.; steel plates, 1.32 to 1.35 cts. for tank, 1.5 to 2 cts. for flange, 2 to 4.5 cts. for firebox.

## INDUSTRIAL NOTES.

THE CONNELL & TUFTS IRON WORKS, at Algiers, La., were entirely destroyed by fire on Jan. 6.

AN IRON AND BRASS FOUNDRY is to be established at Oneida, N. Y., by J. M. Kennedy and Thomas Kelley.

THE T. H. HUDSEY PLOW WORKS, at North Berwick, Me., were burned Jan. 11, the loss being about $40,000.

THE PHOENIX BRIDGE CO., of Phoenixville, Pa., has a contract for a bridge at Scranton, Pa., to cost $87,345.

THE EDGEMOOR BRIDGE CO., of Wilmington, Del., has a contract for a bridge at Scranton, Pa., to cost $72,100.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has a contract for a pier shed for the Long Island R. R.

THE MISSOURI CAR & FOUNDRY CO., of St. Louis, Mo., is building 200 refrigerator cars for the Armour Packing Co.

THE GAS WORKS of the Grand Rapids Gas Co., Grand Rapids, Mich., have been purchased by a New York company for $1,200,000.

THE JACKSON & SHARP CO., of Wilmington, Del., has an order for 12 cars for the Fair Haven & Westville Ry., of New Haven, Conn.

THE MEMPHIS CAR & FOUNDRY CO., of Memphis, Tenn., has orders for tank cars for the Crescent Oil Co. and the Goyer Tank Line.

THE POND MACHINE CO., of New York, has a contract from the War Department for four disappearing carriages for 10-in. guns, at $14,275 each.

SNEAD & CO.'S IRONWORKS, at Louisville, Ky., suffered from a fire Jan. 7, by which the offices and pattern shops were burned, involving a loss of $40,000.

THE ROANOKE IRON CO., of Roanoke, Va., operating blast furnaces and rolling mills, has had liens filed against it amounting to $115,433. The plant may be sold.

A FACTORY is to be established at De Pere, Wis., by the De Pere Electric Light Co., as the water power is at present only used at night to drive the electric light plant.

THE BETHLEHEM IRON & STEEL CO., of Bethlehem, Pa., has a contract from the government for four disappearing gun carriages for 10-in. guns, to cost $15,500 each.

THE UNITED STATES PROJECTILE CO., of Brooklyn, N. Y., has an order from the government for its patent solid drawn steel projectiles, and is purchasing steel for the work.

THE LA ROCHE ELECTRICAL CO., of Philadelphia, Pa., manufacturing dynamos, motors, etc., has made an assignment. The company has a capital stock of $250,000.

THE MINNESOTA IRON CO., of Duluth, Minn., is at the head of a combination of iron mining companies organized for the purpose of raising the price of Bessemer ore from the Gogebic and Vermilion ranges.

THE OHIO FALLS CAR CO., of Jeffersonville, Ind., has filled an order for 500 freight cars of the Pittsburg, Cincinnati, Chicago & St. Louis R. R., and is building 75 freight cars for the Louisville & Nashville R. R.

THE CRAMP SHIP & ENGINE BUILDING CO., of Philadelphia, Pa., has a contract from the W. P. Clyde Co. for a steel coasting steamer of 3,500 tons register; 325 ft. long, 46 ft. beam, and 30 ft. depth of hold.

THE PENN STEEL CASTING & MACHINE CO., of Chester, Pa., has supplied cast steel steam pipe and cast steel leaders for water-tube boilers for the plant of the Narragansett Electric Lighting Co., of Providence, R. I.

THE BIRMINGHAM ROLLING MILL CO., of Birmingham, Ala., has voted to increase its capital stock from $500,000 to $800,000 and to erect a new steel mill. Contracts for the machinery have been placed with Pittsburg firms.

THE CONSOLIDATED ASPHALT CO., of Louisville, Ky., has purchased from Theodore Becker, of New York, 700 acres of asphalt lands near Russellville, Ky. A branch railway is to be built and a plant put in for treating the asphalt.

THE BROOKS LOCOMOTIVE WORKS, of Dunkirk, N. Y., have shipped a third installment of freight and suburban locomotives to the Central Railway of Brazil. The freight engines were described and illustrated in our issue of Sept. 20, 1894.

WENDELL & MACDUFFIE is the title of a new firm organized to deal in general supplies for steam and street railways, and representing the Rochester Car Wheel Works and other manufacturing establishments. The offices are at 26 Cortlandt St., New York city.

THE BALDWIN LOCOMOTIVE WORKS, of Philadelphia, Pa., are at work on orders from the Cleveland, Cincinnati, Chicago & St. Louis Ry., the Southern Ry., the Choctaw, Oklahoma & Gulf Ry., the Cumberland & Pennsylvania Ry., and the Antofagasta Ry., of South America.

THE HARVEY BOILER WORKS, of Harvey, Ill., are furnishing and erecting a stand-pipe at Roseville, Ill. They have recently completed stand-pipes at Woodstock, Morris and Chicago Heights, Ill., and East Chicago, Ind. They have erected 14 stand-pipes during the past year.

THE CASEY & HEDGES MFG. CO., of Chattanooga, Tenn., will enlarge its works to include the manufacture of engines as well as boilers. A new foundry and machine shop will be erected, and an electric crane and other machinery installed, at an expense of about $25,000.

JOHN J. L. HOUSTON, agent for the Pohle air-lift pump, Monadnock Block, Chicago, has a contract from the Anglo-Swiss Condensed Milk Co., of Dixon, Ill., for a pumping plant having a capacity of 7,500 gallons per minute. This is the second order the company has given for Pohle pumping plants.

THE YOUNGSTOWN BRIDGE CO., of Youngstown, O., has been awarded the contract for the Madison Ave. bridge at Indianapolis, Ind., consisting of one span of 83-ft. girders. The company also has the contract for a 4,000 ft. double track ocean pier for the Padre Island Harbor Co., Corpus Christi, Tex.

J. L. KELLY, 1105 Security Building, Chicago, has the contract for erecting the Telephone Exchange Building, requiring 600 tons of steel, at Cleveland, O., and has completed the erection of a building 300 × 110 ft. for the Longwood Iron Works, at Conshohocken, Pa., which included the corrugated work for the whole building.

THE HOOD MACHINE & FOUNDRY CO., of Birmingham, Ala., has an order from Benard & Higbee, railway contractors, of Kansas City, Mo., for 140 pairs of car wheels, axles and boxes, to be shipped to Jamaica, where Benard & Higbee and W. Kenifick have a contract for a new railway that is to be completed by July.

THE ILLINOIS STEEL CO., of Chicago, Ill., has sent E. C. Potter, the Superintendent of its South Chicago plant, to Japan, and it is said that negotiations are pending between the company and the Japanese government for the establishment of steel works, armor plate works and rail mills in Japan, making material from native ore.

A MANUFACTURING BUILDING at Cleveland, O., owned by the Cleveland Gaslight & Coke Co., was burned last week, involving a loss of over $100,000. The building was occupied by several firms, including Bardons & Oliver, lathes and machine screws; C. H. Hunger & Co., brass fitters' supplies; W. C. Facer & Co., ice machines; Geo. Mittinger, metal spinning works; the Eastern Electrical Equipment Co., and a pneumatic rubber company.

McCRACKEN & SEMPLE, railway contractors, of New York city and Pittsburg, Pa., have had an execution issued against them for $76,000 by the Carnegie Steel Co. The claim is on a demand note, made by the firm in 1893, for $70,000, to the order of the Pittsburg, Akron & Western Ry. Co., which indorsed it and delivered it to the Carnegie Steel Co. The note was secured by $160,000 bonds of the railway company as collateral, the firm having built that railway.

THE BALDWINSVILLE CENTRIFUGAL PUMP WORKS, of Syracuse, N. Y., writes us that it is now building a pair of 24-in. pumps of 3,500,000 gallons capacity per hour for the new dry dock of the Craig Shipbuilding Co., at Toledo, O. It also has a contract from the Atlantic City Sewerage Co. for a centrifugal pump for pumping the entire sewage flow, and a contract for a triplex pump for the water-works for Rolfe, Ia. The prospect for business this spring is reported as excellent.

THE F. J. McCAIN CO., the Rookery, Chicago, is erecting a viaduct over the Pittsburg, Fort Wayne & Chicago R. R. tracks for the Metropolitan elevated railway in Chicago; the work will include about 900 tons of steel. It is also putting up the Van Buren St. bridge for Chicago, with about 600 tons of steel, and the power station for the Metropolitan elevated railway, 360 × 100 ft. It is also putting a roof on the power house for the Yerkes railway system at Washington Boulevard and Western Ave.

QUINN & RALSTON, Monon Building, Chicago, have been awarded the contract for erecting the superstructure for the Lake St. Elevated R. R. extension from Market St. on Lake St. to Wabash Ave., requiring about 2,000 tons of steel. They have recently completed the erection of the Fort Dearborn Building, 12 stories, 1,133 tons of steel, at Clark & Monroe Sts., Chicago, and are completing the erection of the Blackstone Memorial Library, at Branford, Conn., with 401 tons of steel and 1,500 tons of Tennessee marble.

THE COPLAY CEMENT CO., of Coplay, Pa., is building a new Portland cement mill. Mr. W. G. Hartranft, Vice-Pres. of the Commercial Wood & Cement Co., of Philadelphia (sales agent for the Coplay Cement Co.), writes us that this mill is one of the most economical Portland cement mills ever constructed in the way of handling material, being designed with the assistance of F. L. Smidth & Co., of Copenhagen, Denmark, and after an extended examination of all the Portland cement mills in Europe by the company's superintendent.

THE WHITE MFG. CO., 356 W. 34th St., New York city, is making snow plows for street railways in which the motor is hung in a cradle inside the car body, and drives the axles by sprocket chains. There is a plow in front of the car, while a heavy adjustable mold board or scraper pushes the snow to one side, leaving a wide cleared space. These plows are used by the West End Ry., of Boston, Mass.; the Brooklyn Heights Ry., of Brooklyn, N. Y.; the Bridgeport Traction Co., of Bridgeport, Conn., and the Consolidation Co., of New Haven, Conn.

THE AMERICAN ASPHALT CO. has been organized at Columbus, O., with a capital stock of $100,000. The company has acquired control of extensive deposits of asphaltic gum and asphalt rock (which is said to be similar to the Neuchatel, Seyssel and Val de Travers asphalts) in Utah, and it is stated that the company will enter into vigorous competition for paving work, and will also manufacture asphalt varnishes, paving blocks, etc. Asphalt filler or grout made from this material has been used with brick paving at Marion, O. The Columbus incorporators include G. W. Sinks, cashier of the Deshler Bank; Gilbert C. Hoover, Henry S. Hallwood and Randolph Coleman, contractors, and W. E. Guerin and F. J. Picard, President and Vice-President, respectively, of the Columbus, Sandusky & Hocking Ry. The asphalt deposits were referred to in our issues of June 8 and Sept. 7, 1893.

COFFIN & STANTON, of Boston, Mass., dealers in water-works and municipal bonds, seem to be coming pretty well out of their difficulties, as Newman Erb, the receiver, in his statement up to Dec. 31, says he has sold securities held by the firm of a par value of $284,000 for $267,777, and received $14,152 from other miscellaneous sources. He has applied $262,194 to the reduction of loans and interest thereon, and $6,599 to expenses incidental to the receivership. Mr. Erb says the several properties which Coffin & Stanton secured control of prior to their failure are being reorganized satisfactorily, and will eventually be put on a paying basis.

THE CRESCENT SHEET & TIN PLATE CO., of Cleveland, O., expects to begin the manufacture of black sheets by April. The buildings now in course of erection are a steel hot mill building, 105 × 175 ft., and a building 105 × 168 ft. (with wing 48 × 48 ft.), containing the annealing, pickling, cold rolling, tinning and warehouse departments. The buildings are being put up by the Shiffler Bridge Co., of Pittsburg, Pa. The Industrial Works, of Bay City, Mich., have a contract for two electric cranes, and the Elwell-Parker Electric Co., of Cleveland, O., will furnish a generator to supply current for these cranes and for 15 arc and 60 incandescent lights.

THE FOSTER ENGINEERING CO., of Newark, N. J., manufacturing pressure regulators, pump governors, etc., reports a rapidly-increasing demand for its new "Class W" steam pressure regulators. Recent orders for large valves include one 10-in. for the Lehigh Valley R. R. coal mines, three 8-in. and one 5-in. for the Watts-Campbell Co., for use at the Newark electric light and power station; one 6-in. for the U St. pumping station, Washington, D. C.; one 5-in. for Dixon's paper mills, and two 6-in. and two 4-in. for the new American line steamer "St. Louis." These latter are in addition to 20 regulators, from 8 to 4 ins., furnished for that ship in December.

THE SOLVAY PROCESS CO., of Syracuse, N. Y., has decided to establish branch works on the Detroit River, near Detroit, Mich., and is negotiating for a site. The company is engaged in the manufacture of soda ash, caustic, bicarbonate of soda and crystals by the ammonia process that some years ago succeeded the Le Blanc process. The Solvay process was first established in Europe 30 years ago; 10 years later it was established in England, and in 1884 the plant at Geddes, N. Y., was started up on an investment of $3,000,000. The company started with a plant of 60 acres, but gradually acquired salt and limestone territory and dumping grounds until now the plant contains about 1,500 acres. The works require 750 tons of limestone and 700 tons of coal daily and give employment to about 1,500 men. In Detroit it is proposed to have a plant of about half the capacity of the works at Geddes, and employing from 1,000 to 1,200 men.

NEW COMPANIES.—Massachusetts Canal Co., Boston, Mass.; $10,000,000, commencing with $10,000; Charles R. Howard, of Boston; B. Berry and James Chandler, of Lynn.

Manhattan Furnace Co., Chicago, Ill.; $300,000; W. A. Sallade and George Wilson.

Boyd Foundry Co., Belleville, Ill.; $6,000; Charles Schlegel, Wm. Moses and Philip Glueck.

Lee Ironworks Co., Galveston, Tex.; $25,000; C. B. Lee, David Weber and James R. Cheek.

Windom Brick & Tile Co., Windom, Minn.; $12,000; T. J. Hunter, John C. Gobel and J. E. Foss.

Crucible Steel Casting Co., Canton, O.; $10,000; John B. Blythe, C. E. Whippy and Rees D. Wood.

Carbon Paint Co., New York, N. Y.; $100,000; Wm. Calhoun, C. B. Hearn and Thomas D. Prentiss.

Electric Purifier Co., Chicago, Ill.; $300,000; George H. Reynolds, A. B. Jenkins and Henry S. Williams.

Galveston & Houston Construction Co., Galveston, Tex.; $25,000; railways and bridges; William T. Sherwood.

Pope Reversible Street Roller Co., Chicago, Ill.; $60,000; Richard C. Pope, Asa W. Waters and E. I. Pope.

Cushman United Telephone Co., Chicago, Ill.; $20,000,000; I. M. Cushman, O. O. Leabhart and Joseph Barton.

La Salle Construction Co., Chicago, Ill.; railway construction; W. E. McClure, C. H. Bumsted and F. S. Donnell.

National Asphalt Roofing Co., East St. Louis, Ill.; $25,000; Hobart Brinswade, C. S. Cobb and James B. Johnson.

New York & Westchester Gas Co., Pelham, N. Y.; $100,000; A. A. Forman, F. B. Case, Jr., and Paul Gorham, of Brooklyn.

Taylor Automatic Car Coupler Co., Findlay, O.; $1,640; Frederick Becker, W. H. Gross and Norman L. McLachlan.

McCullough Dalzelle Co., Pittsburg, Pa.; $10,000, commencing with $1,000; smelting crucibles, etc.; Treas., Conrad C. Arensberg, Oakmont, Pa.

Thornburgh Engineering Co., Akron, O.; $100,000; plant for dumping and unloading railway cars; Wm. Thornburgh, S. H. Pitkin and J. W. Chamberlain.

New Vienna Pump & Engine Co., New Vienna, O.; $5,000; the Hussey double-acting air and water pump and fire engine; M. Rice, J. C. Santee and C. F. Irons.

Phillips Electric Motor Co., Paterson, N. J.; $100,000, with $2,000 paid in; dynamos and motors; F. H. Leonard, of Paterson, and Floyd B. Wilson, of East Orange.

Union Ice Co., Buffalo, N. Y.; ice machinery and cold storage; $100,000;; Thomas J. Nunan and James Lucey, of Buffalo, N. Y.; William F. Wilson, of Pittsburg, Pa.

F. C. Linde Co., New York, N. Y.; $300,000; general and cold storage; Charles F. Linde, East Orange, N. J.; A. A. Doughty, Brooklyn, N. Y.; Edward S. Clinch, New York, N. Y.

Hercoyla Mfg. Co., Jersey City, N. J.; $100,000, commencing with $1,700; ice-making machinery, gas engines, etc.; John Eckes, 123 Franklin St., Jersey City; C. A. Kunzel and Bernard Wessell, New York, N. Y.